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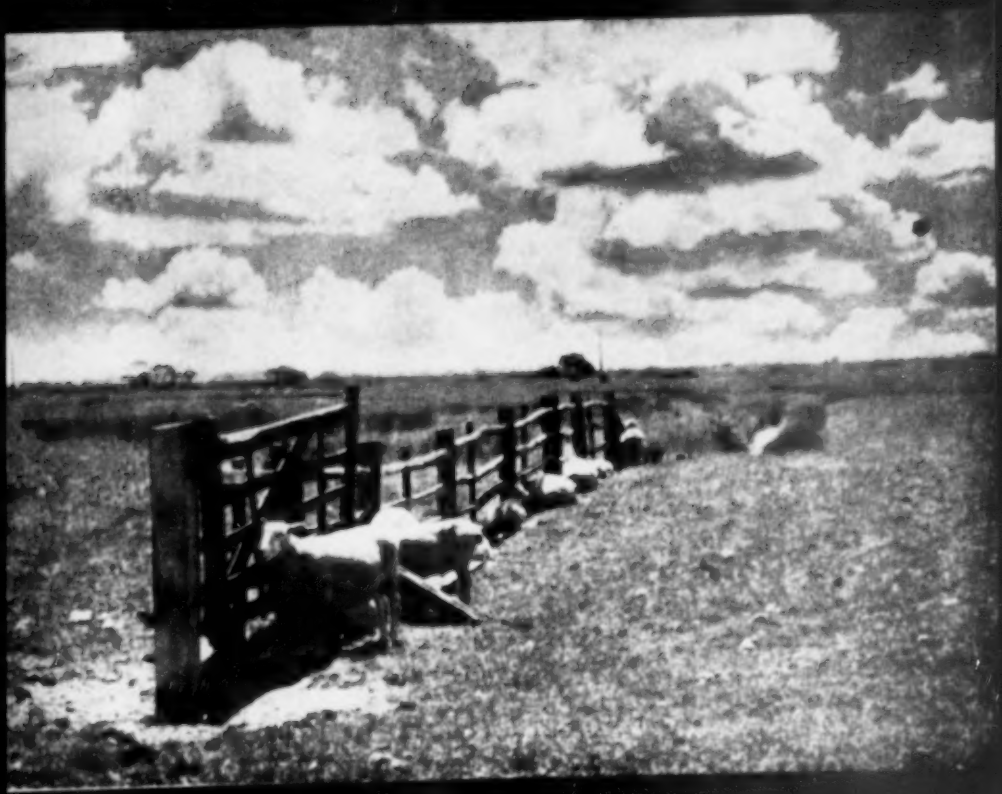

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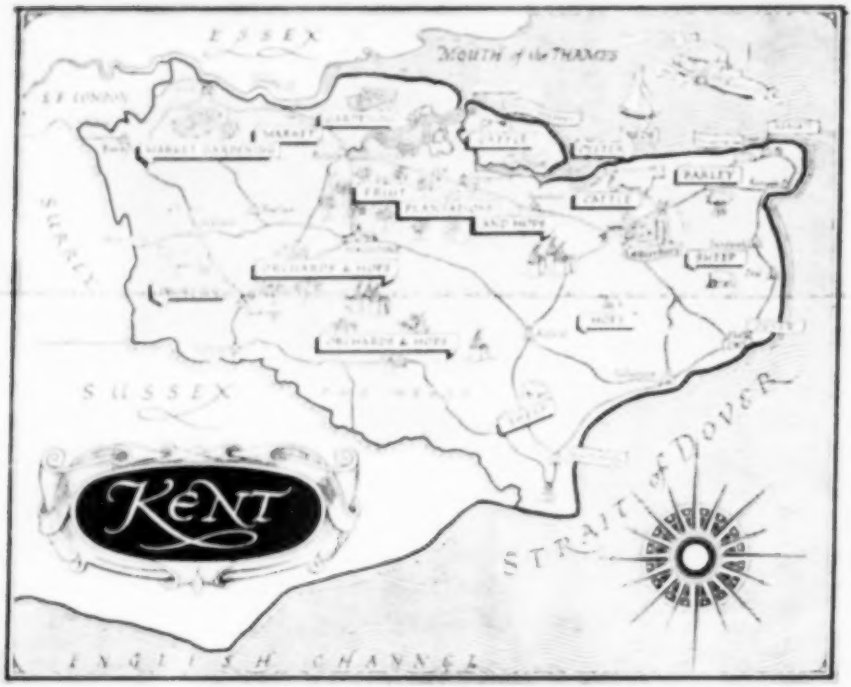

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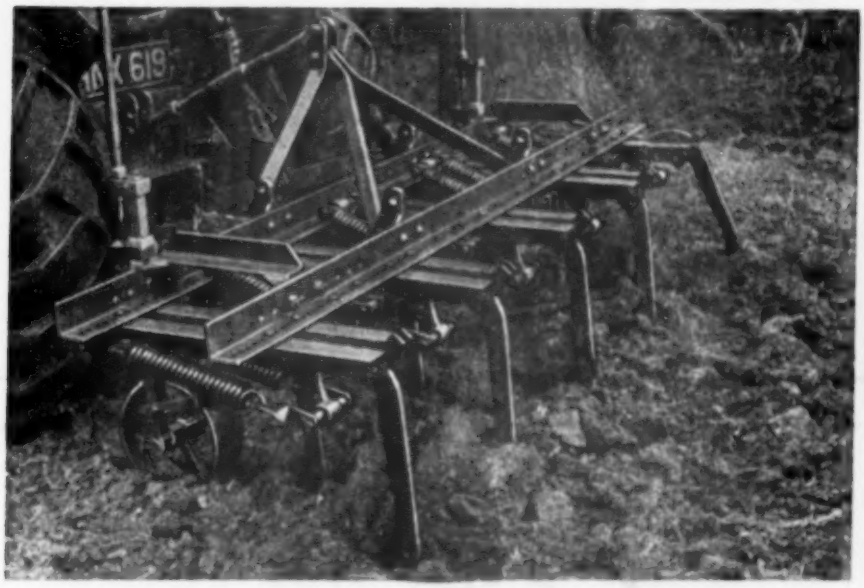

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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Editorial Offices: St. Andrew's Place, Regent's Park, N.W.1 (*Phone: WELbeck 7711*)

VOL. LVII No. 7 OCTOBER 1950

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AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL. LVII No. 7 OCTOBER 1950

LONG LEYS IN THE FENS

FRANK H. GARNER, M.A., M.Sc.

DURING the past few years there has been a strong tendency to put down some long leys in the black fens of East Anglia. Much of this land contains a high proportion of organic matter and usually it is markedly deficient in clay particles; in fact, it is often a mixture of sand and organic matter. Frequently such land is put down to grass because under arable cultivation it is subject to wind erosion. Generally speaking, the soil contains sufficient chalk; in some cases indeed the chalk content is so high that under arable cropping manganese deficiencies have occurred frequently. In many instances, the phosphate content is low and sometimes potash is deficient as well. The nature of the soil makes it lie rather light, and a good deal of consolidation is necessary from time to time to ensure proper growth and development of all crops, including grass. As a general rule, the water-table is low, and in many instances it is impossible to raise it sufficiently to enable grass to benefit directly because neighbouring fields which may be in roots or corn would suffer from a high water-table. Quite commonly, therefore, in the fens it is the low-lying fields that are put down to grass. Indeed, in arable areas it is a recognized practice to put down scattered fields to leys or winter corn, because, by splitting the areas, the risks of wind erosion are reduced. Thus in many instances the grass fields put down in the fens must, of necessity, be scattered throughout the arable areas.

There is yet another reason why some of the fenland has been put down to leys. It is well known that potato root eelworm is present throughout a large proportion of the fenlands of East Anglia, and more recently sugar beet eelworm has appeared. These eelworms have been forcing some farmers to consider putting down leys as a means of widening the rotation and so reducing the risk of growing susceptible crops too frequently.

The Right Species Which species of grasses will thrive in the fens? It has been generally accepted that clover will not grow well there, and that the best grass for fen conditions is ryegrass. Neither of these contentions is right. In the first place, it is possible to grow good crops of wild white clover and S.100 under fen conditions; in fact, I have taken the former for seed production. The growth of clover alters the whole possibility of ley production. Secondly, it has been found possible in some cases to grow lucerne. Ryegrass makes early growth in the spring, but it does not make a good recovery after a hay crop has been taken or after heavy grazing and it does not withstand drought at all well—as was shown in 1949. The grass which outyields ryegrass, under fenland conditions, is cocksfoot. It will grow vigorously, withstand drought and produce feed

all the summer. The only disadvantage is that it does not grow much in the winter, but this is of little importance since normally, under fenland conditions, it is unwise to have stock outside on leys during the winter. Ryegrass should not, however, be ignored entirely; experience shows that Italian ryegrass may be particularly useful. The latter, in the first year of the ley, not only produces some food at once, but it also plays a big part in keeping down weeds, particularly the worst weed in the fen—chickweed. It is possible for chickweed to take complete control and smother a ley in its first winter. Italian ryegrass will grow so vigorously that it will check, and sometimes smother, the chickweed.

A grass which will not grow at all well in the fens is timothy; it does not make enough growth quickly, and consequently chickweed can easily smother it. For this reason, I do not think that timothy should be included in mixtures on the lighter fen soils. It may, however, be quite satisfactory on the strong fen soils—say, on the clays—but, in general, it is not these that are being sown down so much as the lighter, sandy soils.

Satisfactory mixtures consisting of, say, 6 lb. Italian ryegrass, 10–14 lb. perennial ryegrass, 10 lb. cocksfoot and 2 lb. S.100 may be used, and it may be possible to reduce the perennial ryegrass and even increase the Italian ryegrass on fields where the land is very light and chickweed expected to be particularly troublesome. In general, the seed rate should be of the order of 30–35 lb. per acre to ensure a satisfactory plant.

During the last few years lucerne has become a valuable ley crop, and its use has even been extended to the fens. Good results have been obtained by growing it in conjunction with cocksfoot in much the same way as on the high land. Mixtures of about 20 lb. lucerne and 10 lb. cocksfoot have persisted for five or six years and, provided applications of artificial manures are applied every other year, this crop will go on for a number of years. Also, experience has shown that it is possible to graze it into November, and sometimes in February or March, without detriment to the lucerne.

Undersowing in Corn There is much to be said in favour of sowing the ley in corn because of the great risk of land blowing in the spring, and for that reason sowing on bare ground is rather risky. It is true that corn grows vigorously, and there is some danger of smothering, and if by any chance the corn is laid at harvest the risks of smothering are increased. However, provided the corn—usually wheat but sometimes rye—has been grazed well in the spring (as is the custom), the risks of lodging or smothering are very much reduced, and there seems to be much in favour of this procedure. The other possibility is to drill leys in the stubbles immediately after harvest, but experience has shown that this has not always produced the desired results, for although there is very little possibility of blowing, chickweed usually grows more quickly and vigorously than the ley and will smother it in the winter. Thus undersowing in the spring will often give the best results. With the dry conditions commonly prevailing in the Eastern Counties in the spring and early summer, far better results are obtained by drilling the seed than by broadcasting. It is usual to put in the seeds after the cereals have been grazed, at the time cross-drilling is possible, but if for any reason there is some delay and the corn is more than 6 inches high it may be necessary to drill down the rows. Should it prove impracticable to roll after the seeds have been put in, drilling will give a far better germination than broadcasting.

Turning next to manuring, in many cases leys have in the past been put down in corn following roots, and it was thought that adequate manurial

residues from the root crop were present not only to produce a satisfactory corn crop, but also sufficient for the leys. Recent experience, however, has not shown this to be the case. In many instances failures to establish clover in the fen have arisen from an inadequate supply of phosphates. It is a general practice to put down 5 cwt. superphosphate at the time each ley is drilled. This is applied in the spring in the corn so that the ley, and not the corn, shall benefit. As a general rule, no other manures are applied at that time, but it is worth manuring again with phosphates after the ley has been down two or three years in order to maintain the clovers. It is possible that growth on some of the poor fen soils might benefit from applications of muriate of potash; this is generally the case where lucerne is grown, which, however, is not on a very wide scale. It has also been shown that applications of up to 4 cwt. muriate of potash and 10 cwt. superphosphate are worth while applied every other year for leys containing lucerne. It may be more desirable to apply half that quantity annually, but experience so far is insufficient to give a definite ruling on this point.

Management With a maiden ley after harvest it is essential to consolidate the land as thoroughly as possible before the winter sets in. This consolidation is done partly by rolling, but more commonly by grazing; usually the ley is well grazed in the autumn of the first year of seeding. It is important, however, that at this stage it should not be over-grazed, especially by sheep; otherwise chickweed may gain possession and ruin the ley. It is also wise to see that the autumn grazing takes place when conditions are favourable and there is no risk of poaching. Autumn grazing is for the sake of the ley, not for the stock.

It is best to graze the ley in the first year and not to think of haying. This gives the clover a chance to become established and ensures a good bottom to the ley. Grazing may be done with cattle or sheep. With the latter we have had good results from close folding, letting the lambs go forward in the creep. Heavy grazing is carried out with cattle, employing the "on-and-off" system, so that the whole field is grazed down uniformly with a big head of cattle before the stock move out. This gives better grazing than if the number of stock kept on the fields is constant throughout the whole season. Careful grazing is essential when cocksfoot is included in the mixture. Grazing can continue throughout the summer until late autumn, but not through the wettest part of the winter, because of the risk of poaching, for leys do not seem to make a turf in the fens.

For the second year a hay crop can be taken or the crop may be cut for silage and grazed subsequently or grazed for the season, but whichever method is followed, it is customary to graze as much as possible during the remainder of that season. It is unusual to use the same field for haying or silage two years running, although silage-making may not have such detrimental effects as haying, especially if the crop is cut and ensiled when the grass is young. Treatment during the third and fourth years will obviously depend on what has happened during the second year. If hay has been taken, then hay will come again in the fourth year, but if none has been taken in the second year it will generally come in the third year. It is necessary to apply superphosphates after the second year of production, especially if hay has been taken, to encourage the clover. Mixed grazing will continue right up to the end of the ley. Pigs are very suitable stock to graze in the last year of a ley because if they do "rootle" it up it does not matter. The length of life of the ley depends really on how well it lasts. Some leys have been ploughed up after three years and some after seven or eight years, but if weeds (such as

chickweed around the gateways and drinking troughs) are taking possession and productivity is going down, then there is much in favour of ploughing up and cropping for a time before putting down to ley again.

Bloat, often experienced on new leys, does not occur under the conditions described above. This may, I think, be ascribed very largely to the inclusion in the leys of cocksfoot—a grass with a relatively high fibre content. Difficulties with grazing and risks of bloat appear to arise more commonly on the ryegrass-clover leys.

Finally, some information should be given on the stock-carrying capacity of these leys. Throughout a grazing season it has often been found that something between the equivalent of one and two bullocks per acre has been carried. This makes no allowance for the hay crop taken, so that it is common to find that these leys have produced sufficient for two mature bullocks per acre during the summer season.

It can be seen that good leys can be produced under fen conditions, and if precautions are taken when putting the crop down the risk of failures should be greatly reduced. Grazing of the leys calls for care, but with good management leys of four years' duration, giving high yields of food, can be produced with ease.

THE CULTIVATION OF LUCERNE

ROBIN GRINSTED
Chester

LUCERNE growing, once restricted almost wholly to south-eastern England, is now spreading throughout the length and breadth of the country. A well-established stand of lucerne has no equal as a source of high protein herbage over a period of three to six years. Its roots penetrate the soil to a great depth, rendering the plant extremely drought-resistant and able to tap sources of plant nutrient not otherwise utilized. The plant is a true perennial and, when properly managed, will yield heavy crops of up to 15 tons of green herbage per acre in three or four cuts for many seasons. Unfortunately, success with lucerne is not so readily attainable as with more familiar crops, and there have been failures which could have been avoided had proper advice been available at the time of sowing. In preparing this article, the needs of the farmer growing lucerne for the first time are given special consideration.

Most farms have at least one field on which the crop will thrive, but the following requirements must be met, otherwise failure will result. The field must be clean and in good heart. Lucerne cannot withstand heavy competition from weeds, and it is a difficult crop on which to use selective weed-killers. Although a fertility-builder, a good establishment can be obtained only on land initially in good heart. Ideally, lucerne should follow a crop such as roots, which has received dung, but this is not essential to success. The field must also be free draining, or well drained, and the lime status must be correct. The popular impression that lucerne will grow only on a chalky or limestone soil is now disproved. Waterlogging over long periods will certainly kill it, but a well-drained, heavy clay can be quite satisfactory. A dressing of 2 tons per acre of ground limestone will correct a moderate degree of acidity, but it is strongly recommended that a sample of the soil from each field should be tested for lime requirement.

Sowing the Crop For successful growth the correct nitrogen-fixing bacteria (*Pseudomonas radicicola*) must exist in the soil, and unless lucerne has been grown in the field previously, the bacteria must be introduced artifically. A healthy lucerne root shows abundant nodules, each containing thousands of bacteria forming, from the soil air, nitrogenous compounds of value to the plant. The soil fertility-raising power of lucerne, in common with other legumes, is directly due to these nodules.

There is no difficulty in carrying out the seed inoculation, and it is not expensive. Messrs. Allen and Hanburys Ltd., Bethnal Green, London, E.2, manufacture the inoculant, and supply full directions for its use. The only important point to remember is to avoid long exposure of the seed to sunlight after the inoculation, as this will weaken and kill the bacteria.

Correct preparation of the seedbed should receive special attention. Many farmers tend to work lucerne tilth in the same way as they do for a root crop, but it is necessary to pay greater regard to the retention of moisture and the attainment of thorough consolidation. The easiest method is to plough in the late autumn and, in the spring, to work down the resulting frost mulch. Disc harrows will be of especial value, and an opportunity is provided for killing weed seeds soon after germination. No further ploughing should be necessary, and the desirable firm, fine seedbed will be readily obtained.

Lucerne has been established successfully in many ways. It may be sown in wide drills to permit cleaning in the manner of a root crop ; it may be drilled with certain types of corn drill, or it may be broadcast. Undoubtedly the best takes follow the use of a special seed drill equipped with coulters spaced at 4 inches, but these are not always available. At this spacing, weed competition is considerably reduced and a better establishment assured. The best alternative is to use a suitable corn drill at the normal spacing, but special care must be taken not to put the seed in too deep; just under one inch is the ideal.

Many growers regularly undersow lucerne into spring crops of barley and wheat, but new growers particularly are recommended to sow direct, without a cover crop, either during April or May, or during July, following a silage or early potato crop. For a spring sowing the soil temperature must be rising and danger of severe frost should have passed. Autumn sowing should never be attempted.

Manuring and Early Management Although some of the roots penetrate the soil deeply, many remain in the top levels, and the plant responds strongly to dressings of phosphates and potash. It must be remembered that a good crop will remove in a year the equivalent of 3 cwt. per acre of muriate of potash, and about the same quantity of phosphates. There are few fields which can withstand this drain for long, and generous treatment, particularly in the establishment season, is strongly recommended. The following dressing is ideal :

	cwt. per acre
High-grade slag	8 – 10
Muriate of potash	2 – 4

Superphosphate may, of course, be used equally with slag, but there have been consistent high quality results following the use of the latter. Nitrogenous fertilizers should be used with discretion. There is some small evidence showing the possible value of a single light dressing to help establishment, but this has yet to be confirmed. Heavy dressings would undoubtedly depress the desirable root nodule formation. If the soil is in a fertile

condition no nitrogen should be applied. The value of dung to a lucerne establishment is at its greatest when well worked into the soil. It should be applied during the previous autumn or, better still, to the preceding crop.

Eight to ten weeks after growth starts, secondary buds will appear at the base of each plant. On no account should cutting take place until these are clearly seen, otherwise the plant will be weakened. Intrusion from annual weeds often becomes severe at this stage. Treatment with one of the hormone selective weed-killers can be effective, but should be used only on expert advice. To be successful, the quantity of weed-killer must be very carefully balanced to accord with the individual conditions prevailing in the field. A safer method is to cut the mixture of weeds and lucerne for silage or grass drying as soon as the secondary buds have formed. The protein content of such a mixture is always high, and its feeding value surprisingly good. From a spring sowing on weed-free land, the first cut should be taken in August, growth after this date being allowed to stand until the end of October. If sowing is deferred until July, then the growth produced through the autumn months is best allowed to overwinter.

Subsequent Management Lucerne is most suited to a cutting management, and maintains a high protein content well into maturity. When the first flowers are showing, there will be a crude protein content in the dry matter of at least 17 per cent, this being ideal either for silage or grass drying. The crop may be made into hay, but suffers from the disadvantage that the leaves become brittle on drying and readily shed, unless tripods are used.

Strip grazing, controlled by electric fencing, gives a much better utilization. Grazed at the early-flowering stage by this method, danger from bloat will be negligible.

A sound annual management policy is to take a silage cut at about the end of May, graze in August when the drought-resistant properties of the crop are highest, and cut the autumn growth (again for silage or grass drying) in late October. Under favourable conditions one or more extra cuts may be obtained. Management during the autumn and winter is most important. In September and October the plant prepares for the next year's production and should be allowed to grow and strengthen. At the end of October this preparation is complete, and the top growth may be removed without harm. Each year, or alternate year, the crop should be dressed with phosphates and potash—4 – 5 cwt. slag, and 2 cwt. muriate of potash is recommended and will be well repaid.

Dung is often applied to established lucerne stands to encourage maximum growth, but it must be well rotted and free from weed seeds. The companion grass will respond more rapidly than the lucerne and must be corrected by subsequent management.

During December an effort should be made to eradicate any weeds growing with the crop and also to weaken the companion grass. At this time and where the crop is well established, grazing by cattle has often proved advantageous. The weeds and companion grass will be checked, while the lucerne remains relatively unharmed. Naturally, wet spells are best avoided on heavy land, but the dairy herd may, in many instances, be fed silage on the ley during this period. A severe ripper harrowing should be carried out during December, although not during the crop's first winter. If very weedy more drastic action, such as cultivating, will achieve considerable success. Once well established, lucerne suffers amazingly little harm from such treatment and quickly recovers in the spring.

Varieties Of the most commonly known sorts of lucerne, Grimm is considered to have superior powers of winter hardiness to Provence, although if sound strains are selected, both types are equally suitable for cultivation in this country.

English-grown seed tends to be very variable in quality because of the uncertainty of obtaining a well-ripened sample. The climate in this country is likely to prevent any extensive seed production being carried out, unless special strains are bred.

The New Zealand Marlborough strain of lucerne is one of the best at present available. It is of Provence type, but rather earlier and more productive.

A French strain known as Du Puits has received considerable publicity recently, and has shown up well in trials. So far the demand for seed has greatly exceeded the supply. Another strain, Ile de France, has been offered and is considered to be identical to the Du Puits, but it has not yet been thoroughly tested in this country.

Suggested Mixtures On well-prepared land and under favourable conditions lucerne can give excellent results when sown alone at a seed rate of 15 lb. per acre, but higher rates up to 22 lb. per acre are necessary under less suitable circumstances in order to obtain a full plant. An alternative which has become increasingly popular in recent years is to accompany the lucerne with a few pounds of a suitable grass species. The purpose of this is to allow the crop to be sown in close drills and so eliminate inter-row cultivations. The grass tends to prevent the intrusion of weeds and haymaking is facilitated. Cocksfoot has been most commonly used, although in many cases it tends to smother out the lucerne after a few years' growth. Under the dry conditions of East Anglia cocksfoot does not make such vigorous growth, and is still to be preferred, but for all other situations the use of meadow fescue or timothy will give greater satisfaction. In our experience at Chester, only under exceptional circumstances should white clover be added to the mixture, as it will almost certainly thrive at the expense of the lucerne.

Table of Suitable Mixtures

	(*lb. per acre*)			
	1.	2.	3.	4.
Lucerne	22	18	18	18
Cocksfoot	—	4	—	—
Timothy	—	—	4	—
Meadow fescue	—	—	—	4
	22	22	22	22

Diseases and Pests Lucerne grown in this country is singularly free from bacterial or fungal diseases, but insect pests can in some circumstances greatly weaken an establishing crop. In the first-leaf stage, flea beetle may attack and, if the weather is dry and dusty, can practically wipe out the crop in a few days. Fortunately such attacks are rare, and relief is speedily obtained by dusting the plants with flea beetle dust containing DDT.

As with most clovers, pea and bean weevils may cause some damage at a later stage of growth, the control being the same.

LUCERNE AND THE SITONA WEEVIL

WILLIAM DAVIES, D.SC.

Director, Grassland Research Station, Stratford-on-Avon

LUCERNE leys are now being recognized as an integral part of the equipment of the ley farm, especially in the eastern half of England. It is important, therefore, to be able to ensure good takes of seeds, for nothing upsets the farming programme more than a seeding failure. Recent observations at the Grassland Research Station and elsewhere suggest that lucerne leys (as any other) can be established at the will of the farmer so long as the usual and fairly straightforward rules regarding the culture of small seeds are adhered to. Having done all this, however, we still found at the station that there were often unexplained take failures, especially in lucerne. Seeking the explanation, our minds first turned to fertilizers, including phosphate, potash and other nutrient substances, but ultimately (in 1947) we found that seedling lucerne while still in the seed-leaf or cotyledon stage, was often severely damaged by leaf-eating weevils. In our case the weevil which was mainly responsible was the pea and bean weevil (*Sitona lineatus* L.). Clover, lucerne and sainfoin are also often severely damaged by other weevils such as clover leaf weevils (*Phytonomus nigrirostris* F. and *S. sulcifrons* Thunb). It is the adult, or beetle stage of the weevil which eats the leaves, while the larvae are said to feed upon the bacterial nodules which are found upon the roots of lucerne and other legumes.

These weevils are very common throughout the country, and the damage they do to pea and bean crops is well known. The more obvious damage is to the leaf, the edges of which are chewed off while the leaf is still in the bud stage. Sometimes, when the attack is very severe, the growing point and the bud as a whole is destroyed. While the damage to, say, field beans may be very noticeable and the yield probably seriously reduced, yet at least a partial crop will normally be harvested. The same applies to peas, though occasional failures due to this pest are, I believe, to be found where mixtures of peas and oats are grown.

Lucerne seedlings seem to be particularly palatable to the *Sitona* weevil. The most serious attacks from the viewpoint of take can occur just as the seedling comes through the ground in April or May, when the adult beetles are about in large numbers. There seems to be some degree of periodicity in numbers, and our experience at Drayton suggests that there are a number of definite population peaks ; with the result that the adults may appear in large numbers at any time during the late spring and early summer.

Although fully established lucerne and clover are eaten, as in beans the damage done to the mature plant is only partial. In the case of the lucerne and clover seedlings, however, the damage may amount either to complete defoliation, resulting in the death of the seedlings, or defoliation so serious that the plant's establishment is slowed up and the stand is never vigorous. It is possible that part of the lack of vigour may be attributed to the feeding of the *Sitona* larvae on the root nodules.

Control at Drayton There are probably many ways of defeating this pest, but the one which we have found effective and now employ as a routine at the Grassland Research Station is a dressing of 5 per cent DDT dust at about 30 lb. per acre. This is applied with a shandy

barrow or any other available distributor to the lucerne and clover leys as soon as the seedlings appear above ground—normally 10–20 days after sowing. If heavy rain follows the first application we dress a second time, and even a third if necessary. The degree of damage at any given time is fairly easy to assess visually on the field, so that timing of the operations is not difficult. Since the spring of 1947, we have been careful to apply the above control measures on all our leys. This has greatly increased our confidence in the establishment of lucerne and other leys on the Station. We offer our experience to all those interested in leys in general and in lucerne leys in particular.

Thanks are due to the entomologists of the N.A.A.S. for the valuable advice given me on a particular Saturday morning in 1947 when within an hour of receiving that advice, we had purchased the DDT dust and within half a day had applied it. The immediate result was that the lucerne field we were then trying to establish (F.13) looked like a veritable graveyard of dead *Sitona* weevils ; and we eventually got a first-class take of lucerne.

FIFTEEN YEARS FARMING IN SOUTH-EAST DURHAM

W. WADE

Longnewton, Stockton-on-Tees

THE farms of Larberry Pastures (135 acres) and Longnewton Grange (214 acres) are situated in south-east Durham, midway between Stockton and Darlington and about four miles north of the Tees. Longnewton Grange was bought by my father in 1920 and Larberry Pastures in 1926 and were farmed as one unit. Both farms are within a ring fence and have a good road running through the centre. The soil is a fairly strong clay loam, rather wet where it is undrained but, with proper management, capable of growing good arable crops and grass. Being clear of the coal measures, it is unaffected by subsidence. In the spring of 1935 I took over Larberry Pastures on my own and worked it as a separate holding. It had then a useful old farmhouse, but the farm buildings, consisting of an old barn, standings for 16 cattle, four loose boxes, a stable for 3 horses, and two wooden foldyards to hold about 20 young cattle, needed renewal and repair. Of the land, 56 acres were arable and 79 acres old grass.

Building up a Dairy Herd Up to 1935, rearing and feeding cattle and sheep had been the main policy. But in the light of my experience of the beef trade at that time, I decided to take up wholesale milk production, altering the old barn to make it suitable for the production of accredited milk. Water supply was a headache, since all I had was a well and ponds, sufficient under the old conditions but not for milk production. A mechanical pump was fitted, and with this the water was lifted into a tank and so used for cooling, etc. This proved satisfactory for the small herd temporarily. Milk selling began in May, 1935, with 32 gallons from 5 cows and 3 heifers (Shorthorn). The prices of these animals ranged from £13 to £17. I also had an Aberdeen-Angus bull, my intention

being to rear the calves for baby beef and rely on buying dairy replacements. I carried on in this way for two years, but after many disappointments with bought-in cattle, I decided to breed my own. I bought an Ayrshire bull calf from a pedigree herd, and as soon as he was ready for use, disposed of the Aberdeen-Angus.

During the next few years I built up a number of useful cross-bred young stock of varying ages. I also acquired one or two Ayrshire cows. But accommodation for milking cows was limited, so I next decided to build a new cow byre. The old buildings were pulled down, and early in 1939 the new byre to hold 24 cows came into use, along with 6 calf pens, loose box and fodder house. In 1942 I took advantage of the water supplies grant and had a pipe laid from the main at a total cost of £550; looking back, I think this was the wisest thing I have ever done. People who have not had the experience of being without water for man and beast do not seem to realize how serious it can be.

In 1943, on medical advice, my father retired from farming and I took over the Grange Farm. The buildings on this farm were good and commodious though suited for rearing and fattening rather than for dairy purposes, but they proved very useful for young and dry stock. At the same time I had my herd tuberculin tested. Out of 77 head there were 17 reactors, 14 of which were cows. These were sold locally, averaging £60 per head. As most of my in-calf heifers passed the test, replacements were not a serious matter, but I hoped to buy attested pedigree Ayrshires.

A well-known breeder had advertised a sale in the county and I went to buy, but to my disappointment I could not compete with the other buyers. The following day, with the local sale fresh in mind, I travelled to Castle Douglas. I was a stranger in a strange land, but I had a hearty welcome from the auctioneer. I am afraid he did not know how little I had to spend ! I knew nothing at all about pedigrees and very little about Ayrshires. However, I bought the first and second cow that came into the ring and soon after another came down to me. I now felt that I had got on the bottom rung of the ladder and was the proud owner of some pedigree attested Ayrshires. In all, that day I bought five, one very old cow, two young cows and two heifers averaging not much more than 60 guineas. These were all due to calve shortly. On returning home, the next thing was to see the cattle on my own farms. What satisfaction there was to see five Ayrshires wandering round the paddock surveying their new home ! From the five, I had six calves, three bulls and three heifers. All calved safely and were eminently satisfactory. The old cow had twin bulls and went on to give 1,000 gallons. She also had twins the next time, but died from septicaemia. Luck was with me that day at Castle Douglas as I have the other four old cows still going strong. All have given 1,000 gallons in one lactation or more, as also have the heifers and calves they brought with them. In February, 1944, I returned to Castle Douglas and bought a bull at 110 guineas. This was fourth prize-winner in a class of 66, the first prize-winner making 2,100 guineas. This bull left a few heavy milking heifers. Alas, his temper proved too much for me and he went to swell the beef supply soon after his first calves made one lactation. I have a good number of heifers by him, although there is a wide range between his best and his worst, and I am now in the position to keep a closed herd. Whether I am right in my method will be proved in years to come.

At that time we were living under war-time conditions with war-time labour. Land girls were in charge of the herd, and I was never better served at any time in my life before or since. In 1943 one of these girls had taken

the responsbility of recording, and to her must go a lot of the credit for the way the herd was carried on at that time. The health of the herd and rearing of young stock were a credit to those who had the job in hand. By introducing a good bull on to non-pedigree Shorthorn cows, I got some first-class milk cattle. These have carried me through until now, when most of the herd is pedigree except one or two families that have done consistently well. Abortion has been kept in hand from the beginning by the use of that mysterious substance S.19. Sterility persists in popping up its head now and again for no apparent reason. Mastitis, at one time expected only in August and September, seems to be ever-present and most serious enemy, but on the whole the herd can be claimed to be healthy.

I was brought up amongst polled cattle and could never see any use for horns. I tried dehorning calves with caustic soda but with varying degrees of success. I also had the idea that I might not be able to sell my surplus stock without their horns, so after dehorning about 20 calves with caustic soda, I thought it better to wait and see. Soon after, I attended a demonstration and saw dehorning by the hot-iron method. This was what I had been looking for. On my return, my first job was to buy two ordinary soldering irons and shape them to my needs. I dehorned every calf I had that was not too old. In this way a yard that previously held 10 horned cattle now holds 20 comfortably. About 15 older calves were left, but as soon as they came inside for the winter and started to knock the dehorned ones around, I phoned the vet. and borrowed some shears. When milk was cheaper and more plentiful—in April—the vet. and I attended to the cows. We started as soon as morning milking was finished. The vet. injected in the stall, and after ten minutes the cows were led into a crush pen which I had previously made with a strong gate on stout posts. Then, with the help of a man to close the shears, I dehorned all except two old cows; these cows were the oldest on the farm, so we spared them this degrading operation ! In all we dehorned 60 cattle and were finished before lunch. The cows were turned straight into the field to a feed of silage which they ate normally. When they came in to be milked at 3.30 p.m., only one cow was bleeding, and this was soon stopped by an application of cotton wool; otherwise we had no ill-effects. The milk yield dropped from 106 gallons to 102 on the first day, but afterwards it rose well above the level prior to dehorning. All calves are now dehorned soon after birth, which satisfies myself, my staff and that unfortunate cow who by fate is loved by none of her kind.

Three Times Milking In the spring of 1948 some of the old cows were giving over 60 lb. on twice milking. I decided to relieve them last thing at night; they responded immediately, and one in particular rose to 89 lb. This convinced me that to get the best from good animals I must also attend to their health and comfort. Each cow is, therefore, now milked three times daily. The method is as follows :

Three men are employed whole time in the byres. One of these stops work at 3.30 p.m. and does not start again until 6.30 p.m. the following day. One man is off duty each day. Of nine milkings, each worker milks six and misses three. The times of milking are 5 a.m., 1 p.m., and 7.30 p.m. This method is far from perfect and could easily be improved in a larger herd, but in a herd of 40 cows it works reasonably well, depending largely on the class of worker employed. My milk record for the year ended September 30, 1949, from 25 full-time cows, was 10,507 lb.

I have now cut out roots and hay in the winter feeding of cows. During the early part of the 1949–50 winter each cow was fed 80–90 lb. of silage, according to the size of animal. This was reckoned as sufficient for maintenance and 1 gallon. Every additional gallon was allowed for at the rate of 4 lb. oats, either alone or with dairy nuts. As the winter advanced it was evident that the silage was not likely to last out at this rate of feeding. Reductions were gradually made, and in March the cows were fed 43 lb. silage with 6 lb. oats for maintenance and 1 gallon, with 3½ lb. dairy nuts for each subsequent gallon. Twenty-three cows and eighteen heifers were producing 145 gallons daily. Quite a few of the cows have finished their 305-day lactation with records of well over 1,000 gallons, and yields continue to rise. All the heifers have calved since October. However, though no hay is fed, oat straw is given more or less *ad lib.* Cattle at the time of writing number 137, comprising 42 cows in milk, 14 in calf, and 28 heifers due to calve next winter; the remainder are young stock of various ages. It will soon be necessary for me to decide which policy to follow; whether to discard 25 per cent of my older cows—cows which are doing well and will continue to do well for a number of years—or retain these and sell calving heifers which look good but are yet to be proved. As the milk cheque forms the bulk of my income, the temptation is to retain the cows. To increase the herd would entail considerable expenditure on accommodation for both the cattle and the extra labour they would require.

Other livestock on the farm are 70 ewes with lambs, 30 "mule" hoggs in lamb, and 64 feeding hoggs. Two breeding sows are also kept, along with a few poultry. The ewes are mainly "mules," some being Scotch Blackface–Border Leicester crosses, and some Swaledale-Border Leicester crosses. These are again crossed with a Suffolk × Border Leicester ram. An average crop of lambs is about 1¼ per ewe. These lambs, now mostly born in March, are sold fat from August onwards. Ewes are bought in as hoggs at the autumn sales and kept for breeding for a number of years. Many of the ewe hoggs are put to the ram, lambing in April and rearing usually one lamb. All home-bred lambs are fattened, but additional lambs are bought at the autumn sales for fattening.

Old Grass into Arable As already stated, when I took over the land at Larberry Pastures 56 acres were in arable and 79 acres in old grass. Many of the fields had no water supply, and these fields were mainly used for continuous arable cropping. Having known the advantage of ley farming, I decided to plough some of the old grass. By altering fences and by careful planning I was able to lay down several fields to seeds for grazing with access to water. When war broke out in 1939 there was only one old grass field left, and this had trees in it. Many of these fields also required draining, and I made use of a local expert drainer, and tried each winter to get some of the worst places drained. My rotation at that time was ley (three years if possible), wheat, roots and potatoes, with farmyard manure applied on the stubble and ploughed in, and oats undersown with seeds. In these first years the only manures used were farmyard manure, basic slag and a little sulphate of ammonia. I was told that the land contained sufficient potash. Crops yielded satisfactorily. Wheat could yield over 30 cwt. per acre on a first crop after ley, and oats varied around 25 cwt. Potatoes were not successful on this strong land; 6–7 tons was the average yield. Contrary to the usual custom in the county, turnips were sown on the flat. Under these conditions the crop was usually better than when drilled in rows. With the war came the cry for milk, wheat and potatoes. I could manage the milk,

and wheat but had no love for potatoes. As most of my grassland had already been ploughed out, it was not eligible for subsidy, but I decided to have a go at the field with the trees. I dug round the trees, cut the roots, put a wire to the top and pulled them over with a horse. If they would not move in one direction then another was tried until the tree came crashing down. Up to this time all cultivation work had been done with horses, mainly breeding mares and youngsters. The young horses were yoked at two years old and sold at either three or four years. The mares lost only about ten days' work at foaling. I could not afford a tractor of my own, so I persuaded my father to join me, and we shared a new tractor and a two-furrow plough. The old grass field was ploughed for oats in the spring of 1939.

Longnewton Grange which was taken over in 1943, was regarded as a very good farm. The land was strong but it was well drained. Fifty-five acres of wheat which I took over yielded 37¼ cwt. per acre over all. While part of the Grange was worked on the ley system, there were a number of old grass fields at the outbreak of war. These were really excellent pastures, capable of carrying one beast to the acre from March to October and, with a little hay, one beast to 2 acres in the winter period. They had been built up by the regular use of basic slag and cotton cake feeding in the early stages. I regretted ploughing them out; that type of first-class pasture will never be replaced.

The first corn crops on these fields were more of a liability than an asset. They went down badly before harvest, involving much labour; and there was a great waste of grain. The straw also made only very poor fodder. A second white crop, usually wheat, followed. This was invariably successful, yields of grain being 40 cwt. and over per acre. Third and fourth white crops often followed, again with excellent yields. In the early years the crops were grown from the store of fertility in the old grass. Since then the soil is showing deficiencies of one kind or another, chiefly potash. The seed takes are harder to get, the new grass does not stand up to the continuous grazing and treading like the old pastures. The application of balanced manures is necessary to obtain good crops. It is now my practice to apply 2–3 tons ground limestone per acre each time a field is laid to grass. What trace elements have gone to the flour mills and pasteurizing plants I will leave to the scientist to discover. Swayback lambs were other people's troubles before the war; recently they were mine, until I was advised of copper deficiency.

Success with Silage In the winter of 1947 my attention was drawn again to silage. I had seen it fed from a stack in Ireland in 1926 and had tried it myself in a tower silo for two years during the war. A demonstration of silage-making impressed me, and I arranged three sites for four pits. Eighteen acres of mixed corn were sown on land that would have gone down to roots and the rotation pastures were cleared. In the first season I made over 500 tons by cutting practically every grass field. My only implement was a buck-rake, and this was used only for sweeping the crop into heaps to be picked up later by hand and loaded on to horse carts. Cutting and consolidation were done with a tractor and sweeping with the buck-rake. In the first winter all the stock were put on silage—dairy cows, young cattle, fattening cattle, breeding ewes and fattening hoggs; also one work horse used by the byreman.

I found silage to be all that was claimed for it; cows looked and milked well, the store cattle thrived, hoggs did every bit as well as on hay and turnips,

and the ewes lambed fit and milked quite as well as ever before. Since starting silage-making, I have given lucerne a trial. I had 4½ acres under the crop last year. This was sown with cocksfoot on clean, well-limed land in the spring of 1948. In that season one cut, consisting mainly of cocksfoot and weeds, was taken in July, and another cut in October. In 1949 the first cut was taken early in June and made into silage, and the second in August was made into hay. The last cut in October was dried artificially; this yielded 61 cwt. of dried material.

This year I have increased the acreage under lucerne and am trying it alone, adding the grass seed when the lucerne begins to lose vigour. After the winter-sown rye and tares were cut towards the end of May, the land was ploughed immediately and sown with red clover and ryegrass (8 acres), lucerne and meadow fescue (5 acres), lucerne and timothy (5 acres) and lucerne on its own (5 acres). All were sown on May 25, since when the fields have been grazed, the lucerne with ewes and lambs and the ryegrass with dairy cows and calves, the latter being controlled in strips with an electric fence. Notwithstanding the ideal weather, I am amazed at the amount of grazing from the small acreage. I now have 20 acres of lucerne established which I shall strip-graze instead of taking a late cut. In the cattle industry I think we shall be compelled to produce our own food, even at the expense of some yield, either milk or beef, and this can be done by growing high protein crops for silage. I believe that if we rear the young animal on the food on which it must produce when mature, its system will be in a state to convert that food into meat or milk at the appropriate time, provided the food is clean, palatable and balanced for health and production. I have been very successful with a mixture of rye and tares sown in the autumn for silage. In 1949 I cut this crop on May 10—a big, bulky crop of luscious green material. I had also a small acreage of Italian ryegrass; this was also cut in May and provided a big weight of good feedingstuff. These winter-sown crops provide a good start before the grass is ready. Each year I have had the silage analysed by the N.A.A.S. Nutrition Chemist. The following is a typical report :

> I thought this silage to be slightly underheated, i.e., slightly over-compacted, but in the main, well made. At any rate the quality of the material has not deteriorated during ensiling (over 75 per cent of the protein is in the digestible form). In feeding quality the silage is of good standard, especially with regard to available protein. The starch value is not so good, 80 lb. would provide for maintenance plus 1 gallon production from 9 cwt. cow, but again there is an excess of protein present. I suggest you feed 80 lb. (as now) for maintenance plus 1 gallon of milk (87 lb. for a 10 cwt. animal) and then feed 4 lb. crushed oats for each subsequent gallon of milk up to and including the 4th.

Silage is a very good food but it must be fed carefully, as cattle will eat up to 130 lb. per day if they are allowed. It is easily made, always available, and the making lends itself to mechanization, although a large quantity can be made with very little capital outlay. With careful planning the work can be spread over the summer, before and after harvest. Once ensiled, what is not used in one season can be carried over to the next; good use can be made of unskilled labour.

I have tried for the first time covering the pits with waste lime instead of soil, although the soil no doubt makes a good job. I intend to move the lime and waste silage at the same time, spreading it direct on to the land in the hope that the decomposition of the top silage will be quickened and the manurial effect of some value.

The cropping for 1950 was :

	acres
Winter wheat	54
Mixed corn	13
Oats	45
Rye and tares for silage	15
Potatoes	15

The remainder of the land on the farm is ley of various ages, except for 16 acres of old grass and 34 acres of woodland recently reclaimed.

In pre-war days the grass seeds used were of the Cockle Park type of mixture. Some years ago I tried out some simple mixtures such as ryegrass and white clover only, but was rather disappointed with the result. I am now again using a Cockle Park type of mixture, including a fair proportion of S strains with New Zealand white clover. The leafy strains of grasses and clovers seem to be slower in maturing than the commercial strains and in order to get that bite on the stubble so useful in September and October, I have added 8 lb. of Italian ryegrass to the permanent mixtures : from the present appearance, there will be some food for sheep as soon as the stooks are cleared.

The drive for increased tillage means taking the plough round the farm. The old tillage land has definitely benefited, but I am yet to be convinced that the new leys are better than the best old pasture, well manured and managed. The same applies to the tractor versus the horse; the horse has a lot to commend him for the lighter jobs on the farm.

Reclamation of Scrub Land On the Grange Farm there had been two fir plantations covering 34 acres. These had been felled in 1938 and left rough; they were only partially cleared where the tops had been burnt after felling. Each summer the horses not needed for work were turned out and grazed until the pond dried up. Silver birch grew there prolifically; I estimate that the stumps from the plantation ran to 1,000 per acre. In the winter of 1947 the A.E.C. asked if I would have it cleared to provide work for casual labour in the slack period. We arranged a price by contract whereby the scrub was to be cut off at ground level; as the tree roots were so numerous and still sound, I knew it would be too costly to have them removed. The job of clearing the bush lasted well into the spring of 1948. In the summer that year I hired an American stump jump and with a hired tractor and winch and my own old tractor ploughed 20 acres of scrub. The land was undrained, and when the two tractors could not make progress the winch pulled the plough out on to drier ground. This went on until the 20 acres had been ploughed twice each way. Stumps which were loose came out, those which were sound stayed in. The remaining unploughed portion was disced with the ordinary disc-harrows set perfectly straight, to prevent breakages on the stumps. After several discings in this way in the height of the summer, an appreciable amount of loose soil was formed to make a covering for small seeds. The whole had a dressing of 4 tons ground limestone per acre, ½ ton basic slag, and 3 cwt. National Compound No. 1. I ordered seeds with a good proportion of timothy and New Zealand white clover, cocksfoot, ryegrass and a little ribgrass, with the idea that it needed strong grasses and upright clovers to withstand the smothering effect of the original rough grass which was sure to come.

The seeds were sown on the unploughed portion with a fiddle drill, and to cover them we used the front disc and some air raid corrugated sheets to

get a raking effect. Owing to the number of stumps, it was impossible to use either harrows or rollers. The three sheets made a remarkably good job; on striking a stump, each sheet rose over it and went straight back to work.

With advancing summer and other work the ploughed portion lay fallow for the rest of that year. The winter was taken up with laying main drains as a preliminary to mole draining. The depth of main drains varied according to the contour from 2 feet to 5½ feet. They were first half filled with clinker and then covered with soil, by using an earth scoop on a heavy tractor. In the spring of 1949, after the sowing on the farm was finished, we set about the wood again. The ploughed portion was disced three or four times, and manure and seed sown; covering was done with chain harrows and horses. I found that the horses were better to handle among the stumps than the tractor and there were not so many breakages. The stumps will be sound for years yet, although nature and stock will keep them in check. This portion has since been mowed over to keep weeds down, again with horses and a very patient horseman—and again without breakages. I had intended to put at least 30 young cattle and 30 ewes and their lambs on the 34 acres, but this reclaimed woodland has not carried the stock I anticipated and, although the grazing has been very useful, the land must have been in a poorer state than I was aware; it will need much more slag before it is brought to a good standard.

I am now in the fortunate position of having piped water to every field on the farm. This has been made possible by the use of the mole drainer by which we lay water pipes at the rate of 150 yards an hour, including coupling to main, fixing ball taps, troughs, etc., this entirely with my own farm men who are becoming expert pipe fitters.

FORAGE CROP GROWING AND UTILIZATION

J. R. Stubbs, N.D.A.

County Agricultural Officer, Buckinghamshire

VARIOUS circumstances during the war gave an impetus to the development of all-the-year-round grazing. Among them were a shortage of all kinds of food, both concentrates and roughage; scarcity of labour, particularly seasonal labour to cope with roots for animal feeding; and the need for fresh "milk-efficient" foods during the winter period. As a result of this development, and in view of the present high prices for purchased feedingstuffs, many crops are now being exploited for winter grazing. These include the following:

Thousandhead kale	Rye	After grazing, these crops would go on to be harvested as grain
Rape	Oats	
Marrowstem kale	Barley	
Italian ryegrass	Wheat	
	Vetches	
	and various mixtures of the above	

These growing crops are food of the very highest quality held in "cold store" for conversion during the winter. They have the additional advantage of possessing certain milk-stimulating qualities, and cattle grazing them always seem to be healthy and vigorous.

Furthermore, the time taken to feed them is only the time necessary to drive the stock on and off the field.

Growing the Crops In order to make the fullest use of the crops suitable for winter grazing, it is of fundamental importance to learn how to grow them to ensure they are at an ideal stage for grazing just when required. Kale may be broadcast or drilled with an ordinary corn drill during May, June or July, and provided the lime status of the soil is satisfactory, the recommended fertilizer treatment is 3 cwt. superphosphate and ½ cwt. muriate of potash to the acre, together with 2 cwt. nitrogenous fertilizer, half of the latter being applied when the plants are about 2 inches high. Rape should be treated in a similar way to the kales, but as it is subject to mildew attack it is best planted in July.

The preparation of a firm, fine seedbed is of great importance, and it is suggested that the last few harrowings should be made with a chain link-harrow rather than with a tined harrow, as the latter will tend to bring up yet another crop of annual weed seeds to germinate and foul the crop.

In order to get the maximum growth, September sowing of cereal crops can be recommended in some areas, particularly when the seedbed is moist enough for the initial, vigorous establishment of the plant. Where trouble with rabbits is experienced, this early planting is of particular importance and value. Such crops should be combine drilled with a mixture of 2½ cwt. superphosphate and ½ cwt. muriate of potash or its equivalent compound fertilizer, and a top dressing with a nitrogenous fertilizer applied in January or February when weather conditions are suitable. Apart from straight cereals, various successful mixtures include the following:

Rye	2½ bus.
Italian ryegrass	10–15 lb.
Oats	2½–3 bus.
Vetches	1 bus.
Italian ryegrass	10–15 lb.

September-sown rye and ryegrass will provide grazing in November and again in March; oats, vetches and Italian ryegrass provide food in an ideal stage for March and April grazing.

Guide to Winter Grazing Crops

Crops	Seed rate	Tilth	Time of sowing	Time of using	Fertilizers*	Cow meals per acre
Thousandhead Kale	4–6 lb.	Fine and Firm	May to end July	Oct. to Jan.	2½ cwt. s.p. ½ cwt. m.p. 2 cwt. n.	200 to 400
Marrowstem Kale	4–6 lb.	,,	May to July	Oct. to Dec.	2½ cwt. s.p. ½ cwt. m.p. 2 cwt. n.	200 to 400
Rape	4–6 lb.	,,	July	Oct. to Dec.	2½ cwt. s.p. ½ cwt. m.p. 2 cwt. n.	200
Rye	3 bus.	Winter Cereal Tilth	Early Sept. to Oct.	Dec. to March	2½ cwt. s.p. 1 cwt. n.	30 to 100
Wheat	2½ bus.	,,	,,	March to mid-April	,,	30 to 100
Oats	4 bus.	,,	,,	,,	,,	30 to 100
Barley	3 bus.	,,	,,	,,	,,	30 to 100
Rye and Ryegrass	2½—3 bus. 10–12 lb.	,,	,,	Dec. to March	,,	30 to 100
Oats, Vetches and Italian ryegrass	2½ bus. 1 bus. 10–15 lb.	,,	,,	March to end April	,,	30 to 150

* s.p. = superphosphate. m.p. = muriate of potash. n. = nitrogenous fertilizer.

Grazing the Crops With cereal grazing it is generally advisable to put on a concentration of stock sufficient to close graze a field in a period of a week to ten days, and plot sizes should be adjusted to give a stock concentration of between six and ten cows to the acre. They should not be grazed later than the middle of April, and it is advisable to apply up to 2 cwt. nitrogenous fertilizer immediately the cattle have finished grazing, such treatment having a marked influence on increased grain yield.

Occasionally (perhaps with one cow in a hundred) one meets with bloat, particularly when grazing rape. Most trouble is experienced in October or early November during growing weather, when the crop is in an active stage of growth and when there are slight morning frosts. It is important to note that the symptoms seldom appear before the cattle have been grazing for something like twelve days to a fortnight. This is very important, because after such a period the stockman is inclined to think the danger period over and vigilance is relaxed. It is necessary, therefore, to keep a close eye on the stock.

When grazing kale and rape, cattle will not eat more than about 6 lb. of hay per day, and in the past two or three years growers have been experimenting to see how much concentrates could be cut down during the grazing period. The evidence so far collected suggests that one may quite safely expect 6 lb. of hay, plus one full meal of kale and rape (1¼ hours' grazing) to suffice for maintenance and the first two gallons of milk, except for the Channel Island breeds where one should feed concentrates for any production over the first gallon. Milk production costs under such circumstances are as follows :

Yield per cow per day	Ration Fed			Total cost of Ration per day	Food Cost per gallon milk
	Hay	Winter Grazing	Cake		
gal.	*lb.*		*lb.*	*d.*	*d.*
2	6	Full Feed	nil	14½	7¼
3	6	" "	4	25	8½
4	6	" "	8	35½	9
5	6	" "	12	46	9

Prices taken in calculation are Hay—£5 per ton ; Cake—£25 per ton ; Winter Grazing—£9 per acre, supplying 200 cow meals.

Such costs are in sharp contrast to traditional hay and cake feeding which, at present prices, show food costs per gallon as follows:

Yield per cow per day	Ration Fed		Total Cost per day	Total Cost per gallon
	Hay	Cake		
	lb.	*lb.*	*d.*	*d.*
2	20	8	32	16
3	18	12	41½	13¾
4	14	16	50½	12½
5	10	20	59	11¾

When grazing cereals, one frequently meets with quite incredible rises in milk yields due to some special milk-stimulating qualities of spring-growing

cereals, and marked economies can be achieved in food cost per gallon of milk produced. The technique described of all-the-year-round grazing points one way to a considerable decrease in both production and labour costs. It is now a firmly established and well-tried practice, and from the evidence accumulating from farmers operating in such widely contrasting circumstances, it is obvious that the practice is one capable of widespread application. The evidence so far gathered is for dairy herds and milk production ; of equal importance, however, is the fact that the door is open for cheaper winter feeding of beef and mutton.

THE TREATMENT OF MILKING MACHINE CLUSTERS BY THE WET STORAGE METHOD

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THE use of the wet storage method for the sterilization of machine clusters is not new, for in 1931 Parfitt(1) in America advocated its use. In 1948 Hoy and Rowlands(2) published an account of the use of the wet storage method on seven selected farms under normal working conditions, as compared with a control farm using steam. They also suggested a rinse technique suitable for assessing the bacteriological condition of milking machine clusters, and the bacteriological standards that could be adopted for the examination of these rinses. Their findings show that the use of a 0.5 per cent lye solution, or a proprietary detergent X (with or without the addition of hypochlorite) gave very satisfactory results. The seven farms selected for this experiment were not ideal, since the clusters on those farms were in a satisfactory bacteriological condition at the beginning of the experiment. The work of Hoy and Rowlands suggested to us the possible value of a trial on the use of the wet storage treatment of clusters on farms not having any facilities for steam sterilization.

On a large number of small farms in Devon milking machines have been installed with the one idea of reducing the time of milking. This fact, combined with the lack, in the absence of steam, of an alternative method of sterilizing the milking machine and other utensils, has been the cause of a large amount of milk being returned to the farm as unmarketable.

With a view to selecting farms suitable for the purposes of the trial, a number of small farms were visited during the winter of 1948 and their co-operation sought for the following summer. In this way 30 farms of the type desired were selected. These farms were supplied with solution racks, made from odd pieces of wood by a general handyman of the Devon Agricultural Executive Committee ; the most expensive parts of the racks were the brass screws used in their construction. It is estimated that the cost of the racks (including labour) was not more than five shillings each. Before the start of the trial each farmer was visited by one of the County Milk Production Officers and given advice and a demonstration on how to make up and use the lye solution.

The Lye Solution The making up of the solution is a simple matter. The required quantity of flaked caustic soda is weighed on a piece of paper placed on the household scales, and put into a tinned bucket or churn. A little hot water is added and stirred to dissolve the flakes, then cold water is used to make up the required quantity. Suitable quantities to make up at one time are as follows :

¼ lb.	caustic soda	dissolved	in	10	gallons	of water	= 0.5	per cent solution
½ lb.	"	"		5	"	"	= 0.5	" "
2 oz.	"	"		2½	"	"	= 0.5	" "

Flaked caustic soda can be purchased in either 1 lb. or 7 lb. tins from any large chemist, the former costing 11½d. per tin and the latter 4s. 6d. (1s. 3d. returnable on the tin).

During the experiment quantities of not less than 2½ gallons of solution were prepared, since the solution will maintain its correct strength indefinitely, provided no extra water is added. Stock solution must be stored in a glass carboy or a bucket or churn with a tinned surface ; otherwise corrosion will take place.

The method of using the solution is as follows. Immediately after milking, rinse the cluster with plenty of cold water to remove all traces of milk (no brushing is required), then fix it in the lye rack and fill with lye solution. The cluster, when correctly filled, holds about 1 pint of the lye solution which can be poured into the cluster from an enamel jug. The solution is then left in contact with the cluster until the next milking. Just before milking, the lye solution should be drained into the enamel jug. The cluster is then ready to use and there is no need to rinse with water before using, as experiments have shown that traces of caustic soda adhering to the cluster have no detrimental effect on the udder. After using the lye solution twice it should be discarded.

Since steam sterilization facilities were not available on any of the farms, the use of one of the approved hypochlorite solutions was advocated for the sterilization of the milking equipment other than the teat-cup cluster.

Satisfactory Results The operation of the trial was from May 18 to November 30, 1949, this period covering the whole of the summer months when the greatest difficulty is experienced in keeping the clusters free from bacteria—frequently the main cause of milk being of poor keeping quality. During this period rinses from the clusters were taken for bacteriological examination, and samples of lye solution were checked for strength. These check tests were carried out at irregular intervals without notice. The rinses taken from the clusters were tested according to the technique suggested by Hoy and Rowlands, the standards set for satisfactory results being 50,000 or less organisms per cluster, and the absence of milk souring organisms in 1 ml. of the rinse.

During the duration of the trial 166 rinses were tested, 135 of which were satisfactory and conformed to the standards adopted. Further investigation on the 31 unsatisfactory tests proved these results to be due either to the use of weak lye solution or, where the lye solution was at the correct strength, to a very short period of contact before the sterility rinses were taken.

The main bacterial flora of clusters sterilized by the wet storage method has been reported by Hoy and Rowlands to consist mainly of micrococci, which in some cases can multiply in strongly alkaline solutions. Our findings were that micrococci were the predominant organisms in the rinses, except in the case of the unsatisfactory rinses previously referred to, which had a

very mixed bacterial flora. We could not prove that any of the unsatisfactory results were due to a "build up" of alkaline resistant micrococci.

Results of tests on lye solutions showed that 80 per cent were being maintained at the correct strength of 0.5 per cent and that 10 per cent were only a little below. The remaining 10 per cent were very weak and can be correlated with the unsatisfactory bacteriological results mentioned above.

All farmers co-operating in the trial were sending their milk to creameries and in every case where milk was rejected, or came in category "C" on the routine resazurin test, it was found that faulty sterilization of utensils other than the clusters was responsible. This proved to the farmer the necessity for proper sterilization of all utensils even when the wet storage method for sterilizing clusters is being used.

Particulars of the results of the routine resazurin tests and of the number of consignments of rejected milk for the summer of 1948 were obtained from the creameries concerned and these figures were compared with similar tests carried out during the summer of 1949. The figures for 1949, showed a great improvement over 1948 ; for example, two farmers taking part in the trial who had respectively 16 and 21 consignments of rejected milk during 1948, did not have a single rejection during 1949 although it was a very much warmer summer.

Advice to Farmers As already stated, about six surprise visits were paid to each farmer during the trial, and any difficulties that were being encountered with the wet storage method of sterilizing were discussed. The main difficulties were found to be in connection with the differing makes of machine. For example, in the case of machines where teat-cups are not attached to a claw piece, liners were removed and either placed in a glass jar containing lye solution or fixed in a rack and small wooden pegs made to plug the ends. Some makes of milking machines have aluminium teat-cup shells, but the claw piece is made of metal which allows the use of the wet storage method of sterilization of aluminium teat-cup clusters if great care is taken in filling such clusters so that no lye solution is spilt over the teat-cups. When making the lye racks it was noted that milk tubes varied in size with different makes of machine, and the size of the slots cut to hold these tubes must be adjusted accordingly. It was found that the racks must be fixed dead level, otherwise the solution will not reach the rim of the teat-cup liners. This is particularly important with liners which have a deep ridge inside.

Summary of Results The bacteriological tests carried out on rinses taken from clusters sterilized by means of the wet storage process showed that the adoption of this method would ensure satisfactory clusters even during very hot summer weather. The method greatly reduced the incidence of rejected milk and milk coming in category "C" on the routine resazurin test. It ensures, however, only the clusters being kept in a bacteriologically clean condition ; therefore to produce milk of good keeping quality, it is essential to cleanse and sterilize thoroughly all the other equipment used in the production of milk.

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ROMNEY MARSH

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ROMNEY MARSH, which came into the limelight recently as the first area to be investigated by an Agricultural Land Commission under Section 84 of the Agriculture Act, 1947, is an area of roughly 59,000 acres (92 square miles). Of this, 50,000 acres are agricultural land lying mainly in Kent, but part is in Sussex. It has a coast line extending from Hythe southwards to Rye, and is bounded on the landward side by the Royal Military Canal. This canal starts at Hythe and passes in a south-westerly direction along the base of the hills at Lympne, Bilsington, Hamstreet and Appledore, to join the River Rother at Iden Lock, near Rye, a distance of about 21 miles.

The Canal was completed in 1812 on the orders of Pitt at a time when Napoleon had an army of 100,000 men encamped on the other side of the Channel and a flotilla of gunboats at Boulogne threatening our shores. It is 90 feet wide and was 18 feet deep. Its stated purpose was " to impede the progress of an enemy, in the event of a landing being effected on this shore". It was laid out in echelon, so that guns firing from emplacements at the angles could sweep it effectively. The canal has since served as a very useful drainage channel, both for the upland slopes on the west side and the Marsh on the other side.

There was a time when the Marsh was undrained and the inhabitants suffered from ague, but today most of the Marsh is dry and sound for carrying sheep, even in the winter, although the whole of it is flat and the bulk of it lies below high water spring tides. The lowest part—the Dowels area of about 650 acres in the neighbourhood of Appledore—is 10–11 feet below sea level and is drained by pumping the water out of its main drainage channel into the Royal Military Canal. The level nature of the Marsh and the fact that most of it lies below high water level create considerable problems of drainage and sea defence. The cost of constructing and maintaining the sea walls is considerable. The fields are divided by dykes of various depths which carry off the water into the "sewers", and the sewers run the water either into the Canal or into the sea, flood gates opening and shutting according to the state of the tide. Most of the water discharged into the canal throughout its length from Iden Lock to West Hythe flows north-eastward and enters the sea at low tide through a specially constructed waterway known as the Canal Cut which reaches the foreshore half-way between Hythe and Dymchurch. There are seven different points where drainage water from the Marsh is discharged into the sea.

Between the canal and the coast the land is almost level, so there is extremely little fall on any of the numerous watercourses or sewers which intersect it. The height of the water in these drainage channels can be regulated by control sluices at all times of the year. In very wet seasons the water is passed out to the sea as quickly as possible, but in dry weather it is conserved. On the main watercourses there are about 70 points at which the water levels can be controlled, and a large number of smaller controls on the private watercourses which are operated by individual farmers. At the end of each winter these controls are operated with the object of trapping the last of the winter flow, so retaining water in all watercourses at levels which experience has found to be most suitable to the type of farming practised along the length of the watercourse.

There are very few hedges in Romney Marsh, so that for the sheep grazier the watercourses have to serve at least three purposes—drainage channels, to provide drinking water for the stock, and to take the place of fences. The average annual rainfall is only about 25 inches in most of the area, and the grazier likes to keep the level of the water in the dykes as high as possible during the summer in the belief that by so doing he will provide the pastures with a plentiful supply of moisture for maintaining the growth of grass. The arable farmer, on the other hand, prefers a lower level of water in the dykes so that his crops can develop a deeper root system. Thus sometimes there is a conflict of opinion between the grazier and the arable farmer as to the best water level to be maintained in the dykes.

Romney Marsh is popularly thought of as an area of permanent pasture grazed by Kent or Romney Marsh sheep, but there has always been some arable land in the Marsh, the amount fluctuating according to the economic conditions of the time. The depopulation of the Marsh is said to have begun with the Black Death (1349); up to that time it was mainly under the plough. Much of it was again ploughed up at the time of the Napoleonic wars, and again about 1850–60 when corn prices were high. After that it returned to pasture, but even in the great depression of the early 1930s about 10 per cent of the land was arable. Between 1939 and 1948 the arable acreage increased nearly fourfold—from 4,657 acres to 17,538 acres, and 40 per cent of the Marsh is now under the plough.

Grass and Sheep Nevertheless, Romney Marsh is best known for the richness of some of its pastures and for the number of sheep they carry. The Marsh graziers recognize four grades of pasture :

Grade I. Fatting Pastures. These occur on the most productive soils and fatten from 6 to 10 sheep per acre in summer. On some of the most famous of these pastures even higher numbers can be fattened.

Grade II. Breeding Pastures. These are found on soils slightly inferior to and normally heavier than the fatting pastures. They support from 4 to 6 sheep per acre in growing condition in the summer.

Grade III. Breeding Pastures. These are found on still poorer soils which are either too heavy or are too light for optimum moisture retention. They carry from 2 to 4 sheep in summer.

Grade IV. Rough Grazing Land. These very shallow soils carry two sheep or less per acre in summer.

There is a small area of fatting land to be found in almost every parish. Dr. J. K. Dubey of Wye College (see the May, 1933, issue of this JOURNAL) found that practically all the fatting pastures are on a soil formation where the surface layer to a depth of 10–20 inches is loam or silty loam; the texture becomes heavier with increasing depth but is never very heavy, and at 2–3 feet (occasionally 4 feet) it becomes lighter again. The high fertility of these soils is very largely due to the fact that their texture facilitates a perfect natural drainage.

Most of the breeding pastures are found on heavy soils where the water drains through with difficulty so that the land is rather wet. They are also found on light soils which are unable to retain sufficient moisture and are therefore rather too dry.

The rough grazing land occurs on very shallow soils, and includes the shingle of Dungeness. The soil is either very wet or excessively dry.

The quality of the pasture in Romney Marsh in some cases shows a remarkable variation within small areas, and it is a common experience to find a fatting pasture surrounded by breeding pastures. Fatting pastures always

receive the first consideration at the hands of the grazier; and if at any particular time the sheep stocking of a fatting pasture requires adjusting (up or down) it is dealt with accordingly, even though other pastures have to suffer in consequence. Such preferential treatment in management, extending over many years, has doubtless had an influence in the improvement of some pastures and the deterioration of others.

The Marsh pastures vary considerably in the composition of their herbage. On the best fatting pastures more than 90 per cent of the total herbage may consist of four species of plants only—perennial ryegrass, crested dogstail, rough-stalked meadow grass, and wild white clover. A typical pasture botanically examined by Dr. Wm. Davies was found to contain 53 per cent perennial ryegrass, 20 per cent crested dogstail, 13 per cent rough-stalked meadow grass, 5 per cent wild white clover, and 9 per cent other species of plants. The percentage of clover, even on the best fatting pastures, is never very high. Generally speaking, the better the pasture the higher the proportion of perennial ryegrass. The lower the grade of pasture the smaller is the percentage of the above-mentioned four species of plants, until on the poorest breeding pastures these species may form between them less than 10 per cent of the herbage, and there may be as many as thirty or forty different other species present.

The best grass owes much of its virtue to the traditional methods of management. An old test of a well-grazed pasture in Romney Marsh is to throw a sixpence as far as you can and then go and pick it up again. If you cannot find it, the pasture is not being grazed hard enough.

In summer the Romney Marsh is probably more heavily stocked with sheep than any other area of similar size anywhere else in the world. But at the end of August or at the beginning of September it is customary to relieve the pastures of some of the sheep by sending the lambs away, either to be sold in the autumn lamb sales at Ashford, Lyminge, Maidstone and elsewhere or to be wintered until April on the uplands of Kent, Surrey and Sussex or further afield. The breeding ewes and wether tegs, however, remain in the Marsh, and even in the winter the pastures are not really being rested from sheep; they are stocked up to their capacity, usually at the rate of about 2½ sheep per acre. In the autumn one likes to have a fair covering of grass on the pastures to provide winter food for the sheep.

The rams are not put with the ewes until the beginning of November, as lambs are not wanted before the grass begins to grow in April. Normally the ewes receive no artificial food, except in deep snow or hard frost; then shey may get some bean straw or hay. The Marsh is an open, treeless, thelterless area, exposed to the south-westerly gales from the Channel and the piercingly cold northerly and easterly winds in the spring, yet the ewes lamb in the open and the only protection they are given is the shelter of a few straw-thatched hurdles. In the lambing field they may receive a few whole beans, broadcast over the pasture; it would require too many troughs to trough-feed them.

In May, when the grass gains on the ewes, the lambs and tegs which have been wintered away are brought back to the Marsh. In June, if there is a surplus of grass, a few bullocks may help out the sheep, the idea being to graze the land closely until the longest day (June 21) to prevent the grass "running away". The sheep are sent to Ashford market as they get fat. Most of these fat sheep never see any food other than grass from the day they are born to the day they are killed.

Romney Marsh is the home of the famous Kent or Romney Marsh breed of sheep. There is no other breed of sheep that will put up with the

Photo: *Aerofilms, Ltd*

Romney Marsh from the air

Photo: *Mudgraph*

A flat expanse of the Marsh with the little church at Fairfield showing up as a prominent landmark

Photo: *Farmer & Stockbreeder*

A flock of pedigree Romney Marsh sheep

Photo: *John Topham*

An R.A.F. airfield handed back to sheep pasture

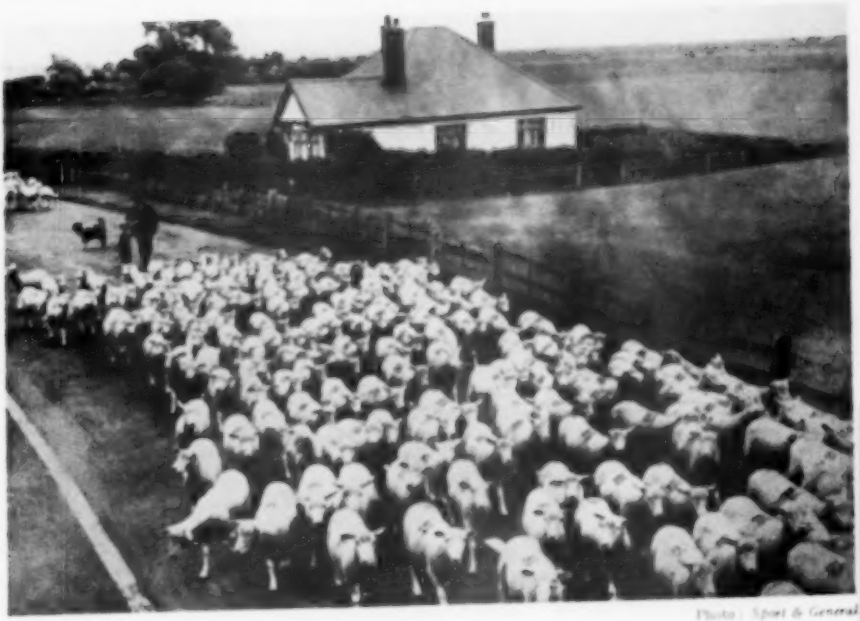

Photo: *Sport & General*

In the spring of 1940, 65,500 sheep were removed from the Marsh to other parts of the country

The Royal Military Canal at Appledon

Part of a good seed crop of wild white clover

Harvesting tick beans for seed

Photo: John Topham

Summer spinach being cut for seed

rigorous conditions, though several other breeds have been tried. Moreover, the Kent sheep is a good grazing sheep; it spreads itself well over the ground and is hardy. It produces a good clip of demi-lustre wool: the ewes average 8 or 9 lb. of unwashed wool, the tegs about 7 lb., and the lambs 1½lb. Shearing is late in the Marsh, and it is customary to shear the lambs as well as the ewes. Wool has always been a very important source of revenue to the Marsh grazier, and at one time land used to be let on wool rents; that is to say, the rent varied with the price of wool. The favourite cross with the Kent ewes is a Southdown ram—the same cross as is used in New Zealand in the production of "Canterbury lamb".

Kent sheep have been exported all over the world. New Zealand and Australia, where they are known as "Romneys," have immense flocks of them. They are also very popular in the Argentine, Brazil, Chile, Patagonia, the Falkland Islands, North America and South Africa. At one time the Falkland Islands had an illustration of a Kent sheep on their postage stamps. In recent years Russia has been buying the breed steadily.

One of the worst features in Marsh grazing used to be the heavy sheep losses. It was said that a man lost the whole of his flock every seventeen years, i.e., 6 per cent per year. The sheep died mostly from a disease locally called "struck," which is in the same group of diseases as blackquarter, parasitic worms and blowfly maggots, but these troubles are now more easily controlled—struck by vaccination, parasitic worms by phenothiazine, and maggots by DDT dips.

The farmer who has a farm on the neighbouring uplands as well as in the Marsh can transfer cattle and sheep from one to the other as required. Some years ago estates adjacent to the Marsh often had some marshland belonging to the estate, and it was customary for the farmers to have on the Marsh, say, 10 to 30 acres of pasture land. But of recent years, when these estates have been sold, the marshland has been disposed of separately, and in most cases has fallen into other hands. There are still a few upland farmers, however, who also farm land in the Marsh, some miles away. Such farmers are dependent on a "looker" or shepherd to look after their sheep for them. The looker is paid by the acre for "lookering" the stock twice a day, to see that none get in the dykes, or gets "cast" or fly-struck. He is also expected to spud the thistles and cut the "emmet casts" or ant-hills.

Diversity of Arable Cropping

Coming now to the arable farming in the Marsh, there is a great diversity of crops grown. "Fresh land," i.e., land newly ploughed out of permanent grass, is often so strong that it is not safe to put corn on it for the first few years after ploughing. So crops like mangold seed, beet seed, turnip seed, blue peas, long-pod beans, potatoes, etc., are grown. Later on heavy crops of corn can be taken, but stiff-strawed varieties have to be chosen. The soil is generally too rich to grow good quality barley.

A serious handicap on the Marsh has always been the shortage of labour. There are nearly 50,000 acres of agricultural land in Romney Marsh and the existing labour force is only 1,250, of which 850 are permanent, i.e., 1 worker for every 40 acres, excluding the farmer and family labour. In years gone by the steam ploughs did wonderful work in the Marsh, and there were a number of sets located there. A lot of the land is heavy, but if it can be ploughed directly after harvest and wheat sown before the ground gets too wet, a heavy crop is assured. Nowadays, heavy caterpillar tractors have taken the place of the steam tackle. Labour-saving machinery of all kinds is essential because of the labour shortage.

ROMNEY MARSH

The June 3, 1949, returns for the eleven Kent parishes which are entirely in Romney Marsh—namely, Burmarsh, Dymchurch, Newchurch, St. Mary's, Brenzett, Snargate, Brookland, Ivychurch, Old Romney, Lydd, and New Romney—provide a general picture of the farming in Romney Marsh today.

Acreage of Crops	*acres*
Wheat	3,176
Barley	511
Oats	1,238
Other corn	56
Beans and peas for stock feeding	610
Potatoes	2,313
Turnips and swedes	111
Mangolds	322
Sugar beet	157
Cabbage, kale, etc.	135
Linseed and flax	487
Orchards	111
Small fruits	25
Vegetables for human consumption (other than potatoes)	2,172
Other crops	1,191
Temporary leys for mowing	1,657
Temporary leys for grazing	1,381
Permanent grass for mowing	1,178
Permanent grass for grazing	17,255
Total Acreage	34,086

Livestock	*No.*
Cattle	4,045
Sheep	87,593
Pigs	1,170
Poultry	34,874
Horses	236

Workers	
Regular men	688
Regular women	156
Casual men	243
Casual women	115
	1,202
No. of Holdings	313

The acreage of vegetables for human consumption includes blue peas 951; green peas 149; broad beans 166; French and runner beans 146; brassicas 187; carrots 118; parsnips 43; turnips 53; onions 53; asparagus 42; and smaller acreages of spinach, beetroot, lettuce, etc.

A number of crops are grown for seed, including beet, mangolds, swedes, spinach, carrots, runner beans and dwarf beans. To prevent cross-fertilization between the seed crops of beet and mangolds, the Marsh is zoned: mangold seed may be grown only in the part of the Marsh north of the Appledore–New Romney Road, and beet seed may be grown only in the part of the Marsh south of this road. Kent wild white clover, Kent indigenous perennial ryegrass and cocksfoot are also grown as seed crops.*

It will be noticed that out of a total area of 34,086 acres in the above-mentioned eleven parishes, 15,653 (47 per cent) are arable. Of these 15,653 acres of arable, 4,925 acres (31 per cent) are under corn, chiefly wheat, and 4,485 acres (30 per cent) are under potatoes or other market-garden crops. As regards livestock, there are 470 sheep for every 100 acres of grazing pasture (as compared with 506 before the war). There are 313 holdings of an average size of 110 acres each, and 844 regular men and women workers, i.e., less than three per holding, excluding the farmer and family labour.

The change-over from sheep and grass to a system of mixed farming which has taken place since 1939 has been fraught with great difficulties. The traditional system of sheep farming made very small demands on labour and fixed equipment and none at all on machinery. There are very few buildings in the Marsh for housing implements or anything else. Many of the farmers and their workers had only a very limited experience of arable farming or knowledge of how to use a plough. Moreover, some of the fields are as far

* An article on Kent indigenous perennial ryegrass appeared in the October, 1949, issue of Agriculture.

as two miles from a hard road, and the bridges over the dykes dividing the fields from one another are only strong enough for the passage of a flock of sheep and would not bear a tractor or heavy implements.

Besides all these handicaps, throughout the war Romney Marsh was in the front line of defence, and all agricultural operations were carried out under very considerable difficulty. In the spring of 1940, when there was an immediate threat of invasion, hurried preparations were made to flood a large portion of the Marsh with sea water, and orders were received to remove all the sheep from that area. This was at a time when the ewes were unshorn and their lambs unweaned. Within three weeks, 65,500 sheep were shorn and dispatched by train to other parts of the country. The main bridges over the dykes and sewers were then blown up. Throughout the war Romney Marsh was under almost continuous air raids and towards the end flying bombs. The area lay in the direct line of travel of the flying bombs from the Boulogne-Calais launching sites to London and more flying bombs fell in the Marsh area than anywhere else in the whole country.

The activities of our own Service Departments in this front line area inevitably rendered farming operations still more difficult. And yet, in spite of everything, the Romney Marsh farmers, with the help of War Agricultural Executive Committee labour and machinery, not only carried on but increased their arable acreage nearly fourfold and succeeded in growing heavy crops. It was a wonderful achievement.

The Agricultural Land Commission, as the result of their investigations, decided that ley farming is the proper system for general adoption in Romney Marsh to ensure full and efficient use of the land for agriculture, that in the national interest the tillage acreage should be not less than 20,000 (it was 17,500 acres at the time of their investigation) and that the acreage under temporary grass at any one time should be something like 5,000 (it was 3,654 acres at the time of their investigation), making a total arable acreage of 25,000, which is approximately 50 per cent of the total agricultural area.

The Commission made certain recommendations regarding the provision of new roads to the less accessible areas, more houses for the additional labour force that will be required, and the building of implement sheds, stores, cattle yards, etc. They concluded their report thus: " We consider that all the recommendations we have put forward for work to be carried out and fixed equipment to be provided for the full and efficient use of the land can reasonably be expected to be put into effect by the owners and occupiers in Romney Marsh, and we do not consider it is necessary for the Minister to exercise his powers of compulsory purchase or hiring."

The result of the investigation is a well-merited vindication of what the Romney Marsh farmers have done and are continuing to do of their own volition.

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APPLE POMACE SILAGE

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National Agricultural Advisory Service, South-Western Province

APPLE POMACE, like sugar beet pulp, is a by-product, and some farmers will know already that it is a nutritious and appetizing food relished by most livestock. "Pomace," or "presscake," is essentially the residue of skins, pulp, core material, and seeds of apples from which most of the juice and soluble constituents have been expressed in the making of cider. Unfortunately, pomace does not keep well and, unless conserved, it soon decomposes and becomes unfit for feeding. Two methods of conservation are possible—dehydration and ensilage—and by either the material can be kept in excellent condition over long periods. Although dehydration certainly has advantages over ensilage, it requires special drying plant and the process is really one for the factory. The ensiling of pomace in contradistinction, is simplicity itself, straightforward, and much more generally applicable ; indeed there are few other materials which can be ensiled with so little expenditure on equipment. Before proceeding with a description of the method of ensiling, it should be mentioned that in this country apple pomace is our only natural source of pectin, a material of primary importance in certain food industries. The various processes whereby apple pectin is obtained do not concern us here ; it is sufficient to record that the further treatment yields another by-product—pectin-extracted pomace—which also has useful feeding value ; moreover, this, too, can be ensiled. The ensiling procedure is the same for both types of pomace, the main distinction being a difference in their feeding value.

In a world of plenty there would seem to be little justification for conserving a by-product like pomace which, at best, is essentially a carbohydrate, not a protein food ; but where "plenty" is no longer an adequate synonym for "abundance," and more livestock on fewer acres is the order of the day, the ensiling of pomace should receive consideration.

In a comprehensive review of the uses of apple pomace, published in 1915, Barker and Gimingham(1) drew attention to the considerable amount of wastage of pomace in certain cider-making districts. They suggested that this wastage was due mainly to lack of knowledge of the various methods of utilizing pomace. In 1933, in a further note, Barker(2) summarized information on the use of pomace as a feedingstuff for livestock, most of the information being obtained from the traditional cider apple-growing districts in the West of England. It was apparent at that time that there were still many cider-maker farmers who thought of pomace as a troublesome waste product rather than a useful by-product.

In the earlier review the writers presented statistics concerning the quantity of pomace available annually in the country as a whole. Although an accurate figure could not be obtained, it was thought that the tonnage might be between 40,000 and 60,000, according to the season. If these figures are still a reasonably valid estimate of the amount of pomace available, it will be realized that this by-product can be a useful addition to our store of feedingstuffs.

In this country pomace silage has not been studied experimentally to any extent, whereas on the continents of Europe and North America the subject

has been given more than casual attention. The most complete studies were those made independently by Warcollier[3] and Crasemann[4,5], both of whom investigated the chemical changes and the losses which occur in pomace during ensilage. In the United States of America, Atkeson and Anderson[6], confirming the results of experiments carried out by Hills [7,8] at the close of the last century, demonstrated that pomace silage was equal to maize silage in the production of milk and butter fat from Jersey and Holstein herds. Practically no attention has been given to the ensiling of pectin-extracted pomace, and recorded experiments seem to be confined to a few carried out by Charley, Ling and Smith[9], at the Long Ashton Research Station of the University of Bristol.

The Making Pomace is, without doubt, one of the easiest of materials to ensile ; being acid in character, and containing, as it does, some readily fermentable sugar, it may be said to be twice blest as a silage material. For instance, the acidity of freshly pressed pomace is roughly ten times the acidity developed in well-made grass or green crop silage. Pectin-extracted pomace is likewise distinctly acid, although to a lesser degree—a point which will be realized from the *p*H values. Taking *p*H 3.0 as a fair average for fresh pomace, pectin-extracted pomaces average *p*H 3.6, whereas green crop silages do well if they come within the range *p*H 4.0 to 4.2. Since acidity is initially so well developed in pomace, there is no tendency, as there is with green crops, for the protein to break down into undesirable products which give rise to pungent, offensive smells in the silage. For the same reason there is little fear of the development of putrifying bacteria. The amount of sugar present in pomace is sufficient for normal fermentation and there is no need to add molasses ; a more suitable addition is common salt, and reasons for its use will be given later.

Careful consideration must be given to the size and shape of the silo in relation to the quantity of pomace to be ensiled and, more particularly, to the daily output from the cider press. First, the *type* of container: this can be either a portable structure of wood or concrete of the usual pattern, or an improvisation such as a clamp or pit. Alternatively, a partitioned-off portion of a building or shed can be used, while for small quantities, barrels, vats, galvanized iron drums or precast concrete pipes of large diameter are wholly suitable. Pomace soon spoils if it is allowed to become wet, so that caution is necessary when siting pits or trenches; it is just waste of time to ensile pomace on sites where water is likely to gain access. Second, the *filling* of the container: aim always at building a thick layer rather than at spreading the pomace thinly. If a large container is used and the daily output from the cider press is not sufficient to ensure a 2-foot layer of pomace when consolidated, it is preferable to arrange matters so that sections of the container can be filled at a time. When pressing is intermittent, or quantities are small, it is a distinct advantage to use a number of miniature containers such as barrels, vats, drums or similar improvised silos. A drum 7 feet high and 3½ feet in diameter will hold all the pomace obtained from the milling and pressing of 3-4 tons of apples, and this quantity can be ensiled at one time if necessary. Note carefully that metal surfaces in contact with pomace must be protected and a coating of bitumastic paint, or something equally resistant to acid, should be applied.

For the ensiling of any appreciable tonnage of pomace, a clamp will be found admirable. It can be constructed in the usual manner, although it is not important to have the sides sloping inwards to the base because pomace does not recede from the containing wall; neither does shrinkage in bulk occur if consolidation is well done. The following description of a clamp

which is in use on a farm in Devon may serve as a guide. The clamp is approximately 36 feet long, one side being an end wall of a galvanized iron building, the opposite side consisting of sheets of galvanized iron inclined slightly and shored up by stout timber ; the width is 5 feet at the base and 6 feet at the top. The two ends, also of stout timber, are well braced to resist the outward pressure of the pomace. Sisal paper lining the walls and ends of the clamp gives adequate protection.

Whatever type of container is used it should be ready, and any other preparations made, before pressing begins. This is important because pomace must be ensiled and consolidated without delay ; if allowed to stand exposed to the air, fermentation will rapidly develop and cause considerable spoilage. Pomace naturally packs closely, but it is necessary to tread firmly as filling proceeds in order to reduce the amount of air in the mass ; if carried out properly there will be no further shrinkage on standing. It should be noted that, in ensiling pomace, there are no waiting periods between fillings as there are with grass or other green crops ; the important point is to put the freshly pressed pomace into the container as soon as it leaves the cider press, without waiting for a rise in temperature ; in fact if the work is done correctly there will be no noticeable rise in the temperature. If the mass heats rapidly it indicates either insufficient consolidation or that the pomace has been left exposed and fermentation has set in.

Use of Salt Salt has already been mentioned as a suitable addition to pomace. Its use is not essential, but it imparts palatability to the silage and may help in other ways. Thus, where there is any large proportion of unsound fruit going into the cider press, the addition of salt to the pomace may check undesirable decomposition and prevent the silage spoiling. The addition should be made at the rate of 1 to 1½ lb. of salt per cwt. of pomace, the salt being sprinkled evenly as filling proceeds. Quantities in excess of 2 lb. per cwt. are likely to render the silage too salty and stock may refuse it. It is interesting to note that in some early experiments carried out by Houzeau, quoted by Warcollier, quantities of the order of 14-20 lb. of salt were used per 100 lb. of pomace. Similar proportions were used in the experiments carried out later by Charley and his associates, but the resulting pomace, although excellently made, was too salty and stock refused to eat it.

No elaborate measures are required to complete the final stages of sealing and finishing the silo, but it is necessary to emphasize again that precautions must be taken to exclude rain and water seepage and to prevent the development of surface mould. When filling is completed, and thoroughly consolidated, the ensiled material should be covered immediately with either clean sacks or sisal paper. Soil or other heavy material is not essential ; it is usually sufficient to put on a thick layer of straw and follow with a thatch. Drums, barrels and similar small containers can, however, be sealed easily with a layer of soil.

The Feeding In the making of all kinds of silage it is inevitable that some nutrients are lost by chemical action. In making pomace into silage it is the carbohydrates, and sugars particularly, which are lost ; this is reflected in the change of composition and is revealed by chemical analysis. Thus, from the analyses in the table below the loss of carbohydrates is evident, and it will be appreciated that this loss is counterbalanced by an increase in the percentage amount of every other constituent of the dry matter. This fact becomes more apparent when adjustment is made to

allow for the difference in moisture content of the fresh and the ensiled pomace.

Centre	Material	*p*H	Moisture	Crude Protein	Crude Fibre	Ether Extract	Total Mineral Matter	Carbo-hydrates
			per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
A	Fresh Pomace ..	3.5	69.60	1.98	7.39	0.41	0.72	19.90
	Pomace Silage ..	3.8	77.30	1.77	5.74	0.78	1.04	13.37
B	Fresh Pomace ..	2.8	64.48	2.28	8.08	0.91	0.67	23.58
	Pectin-extracted pomace ..	3.6	79.19	1.96	6.95	0.76	0.49	10.65
	Pectin-extracted pomace silage	3.1	80.10	2.17	7.02	0.80	0.35	9.56

It will be seen that the moisture content of the fresh pomace from centres A and B was 69.60 per cent and 64.48 per cent respectively, but it needs to be mentioned here that the amount of residual moisture in pomace depends very largely on the method of pressing which is used. The extraction of pectin is, in effect, the removal of one of the carbohydrates, a fact which will be realized from the data obtained from experiments at Centre B.

The few feeding experiments which have been carried out indicate that for ruminants the protein of both fresh and ensiled pomace is of low digestibility; in fact, instances have been recorded where the digestibility of the protein was too low to be measurable with any degree of accuracy. The unsatisfactory agreement in the data obtained from the various digestibility experiments rather suggests the intervention of some secondary cause, such as overheating, as a reason for poor digestibility. The fact that pomace so readily overheats and decomposes could explain at least some of the less favourable results. There is similarly a noticeable lack of agreement in the published starch equivalent values for pomace silage. Thus a starch equivalent as high as 75 lb. per 100 lb. of dry matter is quoted by Watson[10], who names two independent sources of information, while at the other end of the scale, values are quoted at only one-half of this figure. Despite this uncertainty, pomace silage is a highly esteemed source of digestible carbohydrate, and some consider it equal in feeding value to ensiled steamed potatoes. This may be so for the best types of pomace silage but a more modest estimate would place the feeding value of average, well-made, samples as equal to that of wet sugar beet pulp and about twice that of mangolds.

It does not appear that any digestibility data have been obtained for silage made from pectin-extracted pomace. Apart from the experiments of Charley and his associates, already referred to, and a brief mention in a bulletin[11] published by the United States Department of Agriculture that "the residue from the pectin plant known as 'pectin pomace' also has value as feed, and is dehydrated for such use," this by-product seems to have been ignored by experimenters. In the absence of any data from feeding experiments, and with only the crude analysis as a guide, it would appear that silage made from extracted pomace would approximate fairly closely in feeding value to that of swedes.

Pomace silage is a safe feed for adult dairy stock, store cattle and sheep, but because of the high fibre content—and this applies especially to the silage from pectin-extracted pomace—care is needed when feeding it to pigs. Quantities up to, but not exceeding, 35 lb. daily can be fed to dairy cows, also to well-grown store cattle, and the latter do particularly well in winter on a ration of pomace silage and good hay without any supplementary feed. It can be fed to fattening cattle in much the same way as potato silage ; at first 6-7 lb. per day should be allowed, gradually increasing as the stock

become used to it. In spite of the good results obtained by many farmers in feeding it to dairy cows, there still exists in some districts a local prejudice against its use, chiefly because of the idea that it causes the animals to scour and that it may taint the milk. This prejudice may have arisen through some unfortunate misuse, or possibly through failure to control fermentation in the pomace. At any rate, scouring and tainting the milk are risks which are no more likely with pomace silage than with many other foods, provided simple precautions are always taken such as ensiling the pomace before it starts to decompose ; introducing the silage into the ration gradually ; no *ad lib.* feeding; no feeding of mouldy silage ; feeding immediately *after* and not before milking. The qualification for feeding to pigs is that its use should be restricted to those of five score and heavier, and quantities should not exceed 4 lb. daily. Sheep can be given up to 2 lb. per head daily.

Apple pomace silage should not be despised because it is a poor source of digestible protein. Farmers who have experience with feeding it will confirm that it puts "bloom" on a beast's coat which only linseed cake, or a similar expensive food, will excel.

Pomace and Grass Silage Mixture In the experiments carried out by Charley at the Long Ashton Research Station it was demonstrated that pomace could be ensiled successfully in admixture with autumn grass. Although this type of mixture can be confidently recommended, it is necessarily one which is confined to those years when there is a flush of autumn grass. The ensiling procedure for pomace-grass mixtures has never been worked out in detail but it would appear that the acidity of the pomace might be of advantage in procuring the correct type of fermentation. Another advantage of pomace-grass mixture is that with suitable proportions of the constituents and in view of their complementary nature for protein and starch, the resultant silage should be more satisfactorily balanced for feeding.

It may be of interest to mention that mixtures of apple and pear pomace have been ensiled, and it would also seem reasonable to suppose that pomace could be successfully ensiled in admixture with wet sugar beet pulp, brewers' wet grains, and similar by-products.

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THE DAIRY INDUSTRY OF THE NETHERLANDS

J. D. Empson, B.Sc. (Agric.), B.Litt.

Mr. Empson visited the Netherlands on a post-graduate scholarship awarded by the Ministry of Agriculture. His impressions of the Dutch dairy industry will, it is hoped, be of interest to all British dairy farmers.

MANY people imagine the Netherlands to be a land of canals, grasslands, windmills and black-and-white cattle. The importance of the agricultural industry in the Dutch economy should, however, not be overstated, for while farming is important, there are also large manufacturing businesses and, because of the country's position upon the Rhine delta, shipping and trading activities have developed. In all, about 20 per cent of the working population are engaged in agriculture, a proportion lower than that in most other European countries. Livestock production is the backbone of Dutch agriculture, and dairy cattle are found on the majority of farms, but some areas are devoted exclusively to the cultivation of crops and horticultural products.

In 1949 there were 1,453,000 cows in milk and in calf, 93 per cent of the number in 1939. About 70 per cent were of the Friesian breed, and 25 per cent of the red and white Meuse-Rhine-Ijssel breed ; the latter are more dual-purpose in type and can live under harder conditions than the Friesian. The remaining 5 per cent were Groningens, originally mainly a beef breed but in recent years developing towards a dairy type. In 1942 the number of cows in the Netherlands was decreasing, whilst in Britain the number was increasing, but the figures in Table 1 give an indication of the relative sizes of herds in the two countries. At that time more than 80 per cent of the herds in England and Wales had fewer than 20 cows, and nearly half the cows were in these herds, the corresponding figures for the Netherlands being 91.9 per cent and 68.9 per cent.

Table 1

Size of Herds in England and Wales and in the Netherlands in 1942*

No. of Cows in the Herd	England and Wales		Netherlands	
	Percentage distribution of herds	Percentage distribution of cows	Percentage distribution of herds	Percentage distribution of cows
1 – 3	26.6	4.1	36.8	9.9
4 – 9	31.9	16.1	39.9	31.9
10 – 19	23.7	26.7	15.2	27.1
20 – 29	9.0	17.1	5.3	17.0
30 – 49	6.3	21.8	2.6	12.6
50 and over	2.5	13.2	0.2	1.6
	100.0	100.0	100.0	100.0

* England and Wales : Approximate figures calculated from data given in the National Farm Survey Summary Report. Netherlands : Jaarcijfers voor Nederland 1941-42.

The Main Types of Dairy Farming

There are two main types of dairy farming, differentiated by the soil types. The Netherlands may be roughly divided into two parts : (1) the south and east, including most of the provinces of North Brabant, Limburg, Gelderland,

Overijssel and Drenthe, where a large proportion of the land is poor, light sandy soil, and (2) the north and west, where the land is low lying, much of it having been reclaimed from the sea. Most of the former area came into cultivation with the introduction of artificial fertilizers which could supplement the limited supplies of plant nutrients present in the free-draining soils. Here dairying is a part of a mixed husbandry system. Rye and oats are grown mainly for stock-feed, and pigs and poultry are kept. In this area many of the farms are tiny and the farm families large, so that the income per head in the family is often low and there is a problem of surplus labour. Herds are small and the milk collected from each farm is usually manufactured into butter, the skimmed milk being returned for pig-feeding.

Because of their size, the farms are managed intensively, and before the war large quantities of concentrated feedingstuffs were used, so that they have been adversely affected by war-time changes in feed supplies.

The second region, to the north and west of the Netherlands, which includes North and South Holland, Utrecht and the western half of Friesland, is composed mainly of low-lying rich grasslands ; much of this land cannot be cultivated and can be utilized only through grass. Specialized dairy farms are to be found here, with herds larger than those in the sandy soils region. In 1949 the total population of the Netherlands was just over ten million persons, of which a large proportion (very nearly half) lived in the provinces of South and North Holland, in the towns of Amsterdam, Rotterdam, The Hague, Haarlem, and also in Utrecht. The market for liquid milk is therefore concentrated within a relatively small area of the country. Because of this, the dairy farms in the low-lying grassland regions can be divided into those in the neighbourhood of the large towns, producing milk for the liquid market, and those in remoter parts, in the north of North Holland and in Friesland, where milk is produced during the summer months under less intensive conditions for use in dairy factories.

Replacements for the herds producing milk for liquid consumption tend to be brought in from Friesland rather than to be reared on the farm. These farms consist almost entirely of grassland, and feedingstuffs are purchased for winter milk production ; here, too, farmers have experienced some difficulty during and since the war. In fact, they have been unable to produce sufficient milk for the requirements of the consumers in the towns, and supplementary supplies have had to be transported from Friesland and other outlying districts. The only remaining area of importance where farm cheese is still made, the area surrounding the market town of Gouda and Utrecht, lies within this region. Cheese-making takes place during the summer months, of course, and any milk produced in winter is dispatched for direct human consumption. It is surprising that this traditional system has persisted so long, but it is becoming less important. There are now about four thousand farms (two-thirds the pre-war number) engaged in cheese production. On these farms the whey is utilized for pig-feeding and, before the war, pig-keeping was widespread in this area.

Most of the farms in the northern part of North Holland and in Friesland are composed entirely of grassland, but on some a few acres may be cultivated to provide winter feed for cattle. Generally, milk is produced during the summer months and is sent to dairy factories, where it is used primarily in cheese-making. In these two provinces great interest is taken in stock-breeding, and the milk yields of cows and the percentage of fat in the milk are higher than elsewhere. Cattle are exported and are also sent to other parts of the Netherlands for breeding and replacement purposes.

Farm Management The cows remain in the open during the summer months and are milked in the fields. Throughout the winter they are kept in byres. Different parts of the country have characteristic designs of cow-byres, but usually the farmhouse, cow-byre and dairy are in one building, the farmhouse being at one end with the dairy and cowshed behind it. As the cows spend all the winter indoors, there are deep dung passages in the cowsheds and, often, some form of reservoir for storing liquid manure. Although the use of milking machines is increasing, milking is still most commonly done by hand because the size of herds is small and milking is usually carried out by the farm family. In view of this, the introduction of machine milking does not necessarily mean a saving in labour costs. An interesting venture into co-operative milking has developed,

whereby a jeep, based upon a co-operative dairy factory, is fitted with a milking machine and is driven round to a number of farms to milk the cows and bring back the milk.

There is a small Government subsidy on concentrated feedingstuffs which are rationed on a per cow basis rather than on the quantity of milk delivered, the system used during the German occupation. Straw for bedding and roots are imported from the crop-growing to the all-grass farms for use in winter. In the north and west great attention is paid to the production and conservation of grass which is, of course, the basis of dairy farming in these regions. Relatively large quantities of fertilizers are applied to grassland, rotational grazing is practised, and Texel sheep may be kept to make full use of the herbage. The grass is conserved for use in the winter in the form of hay, silage and dried grass. In 1947 there were about one hundred and fifty grass-drying plants in the Netherlands, of which over half were co-operatively owned by farmers.

Livestock Improvement Milk recording is carried out in societies consisting of a village or dairy factory unit, supervised by provincial milk-recording services run by the State Livestock or Dairy officers which are in turn subordinate to a national authority established in 1943. This authority prescribes rules for milk recording, collects national statistics of milk-recording data, and encourages farmers to record their milk by offering subsidies towards the costs. These subsidies are paid from a levy on all milk sold from farms ; half of this levy is devoted to providing facilities for combating animal diseases, and from the other half contributions are made towards the expenses of participating societies. The actual amount of the grant depends upon various considerations such as the size of the herd and the frequency of testing. In 1949 47.3 per cent of the cows were recorded. Weighings take place at least every four weeks and usually at intervals of two or three weeks ; all cows on a farm must be recorded and a cow's production is calculated for the whole lactation.

Bulls kept to serve cows on more than one farm must have a pedigree, and their female progenitors must have reached certain minimum production standards. The co-operative ownership of bulls is common, and in 1943 a scheme, similar to the Premium Bull Scheme in this country, was started to make full use of the better bulls. It was not until the end of the war that artificial insemination became generally practised, but in the Netherlands its importance lies as much in the eradication and prevention of communicable diseases as in the improvement of dairy cattle. In 1949 there were 171 societies, and about 200,000 cows (14 per cent of the total) were served in this way. At first the artificial insemination societies were usually small, having only one or two bulls and employing one inseminator. As in this country, only licensed organizations of farmers can operate centres. The work must be carried on under the supervision of a veterinary surgeon, and the members of these societies must have all their cows milk-recorded ; the progeny of artificial insemination services must be registered. The Friesian Cattle Herd-book Society registers only the pedigree Friesian cattle in that province, whilst the Netherlands Cattle Herd-book Society registers the pedigree cattle in the rest of the country and has a separate herd-book for each breed.

In each province associations consisting of representatives of the farmers have been set up. The primary purpose of these associations is the eradication of tuberculosis in cattle, but in the future they will provide a comprehensive health service. They are financed from the levy on milk sold off farms and by contributions from farmers, who pay a certain amount for each

cow kept. The development of the cattle health service in Friesland is particularly interesting as an example of how such a service can develop from farmers' associations. In 1919 the Union of Co-operative Dairy Factories in Friesland and the Friesland Cattle Herd-book Society started a health service open to co-operative dairy factories or other associations of farmers. In 1928 the Association of Private Dairy Factories in Friesland started a similar service. The two were combined in 1947, and in the same year comparable organizations were established in other provinces. As has been mentioned, the first aim was the eradication of tuberculosis ; the cattle are tested annually and all reactors are clinically examined, and those thought to be spreading the disease are slaughtered. Reactors are segregated where this is possible. In 1947 only 2.5 per cent of the cattle of Friesland were outside the scheme, and of the remainder only 2.3 per cent reacted when tested.

The Production and Utilization of Milk

From Table 2 the effect of the war upon dairying in the Netherlands is obvious. In 1945 milk production reached its lowest ebb, for in that year the country became the scene of battle operations which disrupted the activities of the country and resulted in considerable hardship to many people, particularly to those living in the towns, who had great difficulty in obtaining food. By 1949 the number of cows and the average production of each cow had approached or returned to their pre-war levels.

Table 2

Number of Cows, Average Production of Milk per Cow, and Total Production of Milk in the Netherlands, 1939-49

Year	Cows in Milk and in Calf	Average Production per Cow	Total Production
	Thousand head	*gallons*	*million gallons*
1939	1,549	746	1,133
1940	1,492	732	1,090
1941	1,344	661	889
1942	1,226	538	659
1943	1,161	502	583
1944	1,138	491	559
1945	1,164	475	552
1946	1,258	607	765
1947	1,297	602 (very dry summer)	781
1948	1,324	743	983
1949	1,453	810	1,177

Source : Statistics of the B.V.Z. (Dairy Board) and Central Bureau of Statistics.

Before the war nearly half the milk produced was made into butter, and half of this was exported. About a quarter of the milk was consumed in liquid form and 20 per cent was made into cheese, of which again nearly half was exported. Since November, 1940, milk for liquid consumption has been standardized to a fat content of 2.5 per cent. Milk for this purpose is skimmed or diluted with skimmed milk and the butter fat is used for other purposes. With the decreased supplies available, the liquid market received first priority and the proportion of milk consumed increased.

Table 3

Percentage Utilization of Milk produced in the Netherlands in 1939 and 1947

	1939	1947
	per cent	*per cent*
Production of butter	48	35.5
Consumed in liquid form	24	43
Fed to stock	4	4
Production of cheese	20	14
Production of other milk products	4	3.5
	100	100.0

Source: Estimates made by Mr. A. O. P. Verkinderen.

When milk was scarce its utilization was carefully controlled by the Bedrijfschap voor Zuivel, a semi-official organization set up by the Government. This body allocated the milk to various uses and controlled the production, sale and export of milk products. With increased supplies, however, controls have been relaxed and the B.V.Z. now no longer exercises a direct influence on the ultimate use to which the milk is put, except that when circumstances necessitate it, they are responsible for the diversion of supplies into the liquid milk market.

The increase in the quantity of milk produced since 1947 has mainly been used for manufacturing purposes, so that the proportion consumed in liquid form has declined.

Some idea of the use to which milk is put in various parts of the country can be obtained from Table 4 below. In 1947 half of the milk sold in the liquid market was consumed in North and South Holland—the most highly

Table 4

Percentage of Liquid Milk Consumed, and Butter and Cheese Produced in each Province in 1947

Province	Liquid milk consumed	Butter produced	Cheese produced
	per cent	*per cent*	*per cent*
Groningen	3.8	5.7	3.8
Friesland	4.3	21.2	45.6
Drenthe	3.2	9.4	5.7
Overijssel	5.7	17.8	7.2
Gelderland	9.3	16.7	1.2
Utrecht	7.4	2.1	6.3
North Holland	20.1	5.7	13.5
South Holland	27.2	3.9	15.1
Zeeland	1.2	0.5	—
North Brabant	11.5	14.4	1.3
Limburg	6.3	2.6	0.1
	100.0	100.0	100.0

Source: Statistics of the B.V.Z.

populated areas. Although 20 per cent of the butter was made in Friesland, large quantities were produced in Overijssel, Gelderland and North Brabant where the small, mixed dairy farms are found. Friesland is by far the most important cheese-making province. Of the cheese produced in South Holland, two-thirds was made on farms. In general it can be said that

cheese is made from milk produced in the grassland areas, butter from that produced on the small farms in the south and east, and milk is sold for direct liquid consumption where the main centres of population are to be found.

Milk Marketing and Manufacturing The handling of liquid milk in the neighbourhood of the five large towns mentioned above was carried out mainly by private businesses before the war. A farmers' co-operative organization did exist but it was largely concerned with price negotiation. In 1944 this organization was reconstituted and began to take part in the handling of milk in competition with the private concerns. The production of dried and condensed milk was also largely under private control. But much the greater part of cheese- and butter-making has always been almost entirely carried out in factories co-operatively owned by farmers.

Co-operative butter factories were started about the end of the last century after the invention of the mechanical cream separator. The co-operative factory production of cheese developed at the same time. In 1948, out of a total of 614 milk collecting centres (including factories and dairies), 423 were co-operatives, and of the 330 cheese and butter factories, 293 were co-operatively owned by farmers. The co-operative dairy factories are linked through provincial organizations into a federal union. This central organization represents the interests of its members in all matters concerning them, including assistance in legal and technical matters, and the purchasing of requirements for dairy factories. The private dairy factories are linked into an organization with similar functions. In addition, more than half the co-operative dairy factories are members of co-operative marketing concerns. There are seven of them (the best known being "frico" in Leeuwarden), and through them much of the produce of co-operative dairy factories is distributed to both home and foreign markets.

The organization and policy of the co-operative dairy factories is not always the same, but their rules are generally based on a guide drawn up by the provincial federations. They are usually run by salaried managers under the supervision of a board elected from members. This board may consist of about seven men who serve on it for a number of years to ensure continuity of experience and policy. Societies are usually financed through the Raiffeissen co-operative banks. In most cases farmers are paid for their milk fortnightly. The federation of co-operative societies in a province may suggest a price to be paid for milk, but not all factories give this price and the dividends they pay are, of course, different. Transport from farm to factory is provided by the factory, and the costs are borne by it, not by the individual farmer.

A comparison between dairying in England and Wales and in the Netherlands is of interest to all sections of the dairy industries in both countries. Each has something to learn from the other of its organization and farm techniques ; the efforts of Dutch agriculturists to combat cattle diseases provide an example of the first. Each farmer can attempt to eliminate the diseases in his own herd, but progress can best be made on a group or national scale. The development, financing and structure of organizations to control these diseases in the Netherlands are worthy of investigation, for such arrangements can make great contributions towards increasing the efficiency of milk production. With regard to farming methods, grass production, although it has, of course, always been important, is likely to become of even greater importance in the agricultural economy of this country. Here, too, the British farmer can benefit from the knowledge and experience of his counterpart in the Netherlands.

GUINEA FOWL

WILLIAM RHEAM

Llanarmon-yn-Ial, nr. Mold, Flintshire

GUINEA fowl have gained a new popularity in the last few years, mainly because the sale of both their flesh and their eggs is uncontrolled. Several varieties of guinea fowl are found wild in Central and South Africa. Some are plain-headed, some have feathered crests, and some—the original of our domestic race (*Numida meleagris*)—are helmeted. The last-named come from West Africa, where they are called the Vulturine Royal Guinea Fowl. They are found also in the West Indies and India. The Greeks and Romans knew of a variety found in Abyssinia. Guinea fowl were introduced into Britain possibly during the seventeenth century. In the West Country they are known as Gallinaes. By nature they are wild birds, but they can become quite tame, especially with those who feed them.

The commonest type in Britain is of dark lavender grey in colour, dotted with pearl-like white spots, the neck is hackled, the top of the head is horned and red wattled, and the legs are slate coloured. It carries the stern low, and has an arching back and tail in one long circular sweep. There is a white domestic variety, said to be found wild in Madagascar, also a sky blue, introduced from Italy, and there are dun and pied varieties. They do not sex-link.

With practice, sexing is quite easy when the birds are fully grown. The cock's helmet is larger and more upright than that of the hen ; also his wattles are much larger, thicker, and tend to stand out from the head. Chicks can be sexed at ten weeks by listening to the voice. The male gives a one-syllable shriek "back," repeated quickly ; the female a two-syllable cry, the well-known "come back, come back." The cock is larger than the hen—about 3½ lb. to the hen's 3 lb. when fully grown—and has a way of strutting on his toes with his back arched.

Breeding and Rearing Guinea fowl are monogamous in the wild state. I have had 100 per cent fertility with two hens to a cock early in the season. Some breeders have as many as six females to a male with good results. They usually take twelve months to come into production, and I have known them to go on breeding up to fifteen years of age. Laying starts in the early spring, and a good strain of bird should carry on into the autumn, laying over 200 eggs; an average hen should certainly manage 100 in a season. The eggs are cream coloured, often mottled with brown, and pointed at one end, and the shells are remarkably thick. To lay well the birds must, of course, be fed well, but their appetites are small. They require the same sort of food as poultry, though they will eat anything—as some gardeners have discovered ! When off lay they can be relied on to find much of their own food on free range—and that is much the cheapest way of keeping them.

Guinea fowl can hatch and rear their chicks if left strictly alone ; they cannot be moved to a coop like broody hens. But when hatched in this way, the chicks tend to be wild. Guinea hens are inclined to go broody at the back-end and stay on their nests ; I lose several each year to foxes through inability to track the birds down. I have always found hatchability and rearability excellent. The eggs can be hatched in incubators, the thermometer being lowered a little, as the eggs are smaller than those of hens. They hatch about the twenty-eighth day, and rear well in a chick brooder. Last year I put nineteen eggs under one six-year-old Rhode Island Red hen.

and she hatched and reared eighteen. A dog stole the nineteenth! Apart from dampness, which is the chicks' chief enemy, I have found them as easy to rear as chickens; more intelligent, more attractive, and not so liable to catch the many poultry diseases. They have remarkable powers of recovery too. Several times I have found day-old chicks lying cold, wet and hardly breathing, outside a nest. Put back they soon recovered.

The chicks are tiny, mouse-like creatures, little bigger than pheasant chicks, brown striped, with red beaks and red legs. They are very timid at first, creeping about uttering sad cries, and if they get away into long grass they are very difficult to trace and still harder to catch. For this reason it is best to keep them confined to the coop and run for at least three weeks, until they become tamer. I then let them run loose in a wood.

Management and feeding are the same as with chickens but, having smaller crops, they need feeding at least six times a day. Last year I tried having baby chick pellets always before them, with good results, although they were apt to become uncomfortable when they over-ate. Their green food should always be cut up. Often I have pulled 6-inch long pieces of grass, chickweed and watercress out of their beaks. How they manage to get that much into their crops is remarkable, but they do, and soon choke if not noticed in time.

I have reared them with turkeys under hens, and they have done well together. They get very upset when the broody eventually leaves them, and trail behind any hen that isn't fast enough to get away. I remember one gang of forty which when deserted by their broodies, had the good fortune to find another hen not quite over her broodiness. She didn't like them at all but just couldn't escape. They would hem her in and peck speculatively at her eyes and wattles, then peck at each other. Later, they are apt to follow hens for a different reason, hanging on their wings and "ganging-up" on them, though I have not known them do any real damage. This unpleasantness is usually confined to the mating season, when they become real pests if confined with poultry. During the rest of the year they are not so aggressive, although they will sometimes attack each other. I once watched two cocks chase each other for a full two hours. I kept stopping them, yet when I moved away they started again, running very fast with beaks open. They never attempted to fly, and the running pace never slackened. Although they come from the tropics, they seem to feel the heat more than hens, for on our rare very hot days they stand about with their beaks open, gasping.

Housing Wire netting seems to puzzle guinea fowl. I have seen them running up and down three-feet-high netting for hours, flying over only when shooed. Although they can be kept in totally enclosed wire runs, it is only when they are able to wander at will that they are really happy. I have never had any fly away. They need no housing, seeming to prefer sleeping in trees—the same trees every night—but it is useful to train them to roost in a house, where they are easier to catch and may also lay their eggs. Some will inevitably continue to lay in the fields or on banks. The best plan in this case, if one has the time, is to mark the spot where a cock is standing alone, usually between ten and eleven in the morning. His hens will not be far away, and in the evening a search can be made for the nests, just a hollow in the ground, and some of the eggs taken. On no account should all the eggs be taken otherwise the birds will desert.

Even in the worst winter weather my guinea fowl stay on their bare roosting branches, though the heavy snow of a few winters ago caused a few females to retire into a nesting shelter provided for them. Many guinea

fowl were found frozen to the branches of trees that winter. Mine sleep in oak trees on a mountain over 1,000 feet up. Often, in torch light, I have noticed the frost glistening on their backs, or seen them hanging on for their lives in a gale ! When youngsters first take to the trees, great care is needed to see them all safely up at dusk. They get stupid at night, and if any are left on the ground, they are easy game for foxes, etc. Also, on moonlight nights, I have known them, when frightened, to fly off in all directions, and on occasion I have picked up some with broken necks.

I have known birds to cry all night long, and this can become very tiresome near the farmhouse. My own birds I keep in trees some distance away. I have found it best to introduce them to the farm, or rear them where they are wanted to stay. It is best to make sure that some trees or their houses are handy, and feed them there, and it is fairly certain they will always roost there in future. During the day they will wander all over the farm, sometimes going as far as a mile away, and always in tight formation. If reared separately, guinea fowl gangs will not mix, unless they are shut up together for a long period when young. This wandering is one of the bad things about guinea fowl, for, if they get into a neighbour's corn, he may well have something to say about it, particularly as, once having discovered the corn, they will return again and again. The same thing happens with vegetables and kitchen gardens.

Use as "Watch Dogs" Guinea fowl have a reputation as "watch dogs," making an irritating noise like the creaking of an ungreased axle when a stranger invades their territory. For this reason I think they may be kept more widely. I am satisfied that adult birds by their noise do actually keep foxes away and also give warning of the arrival of other visitors. Some farmers now keep flocks of a hundred or more for these purposes. I have left cockerels out all night where the adult birds roost, and none were taken. I have done the same thing on another part of the farm where there are no guinea fowl, and all vanished. They do not, however, keep birds of prey away from young chicks in the daytime. Young guinea fowl up to a year old frighten nothing away ; in fact they are themselves liable to be taken by foxes, even in daylight.

How to catch guinea fowl when they roost in trees can be a problem. If they are on the lower branches they can be dazzled by torchlight, then grabbed. I recently moved to a new farm and was very concerned how to catch my flock. Eventually I had the idea of feeding them inside a wire cage open at one end every evening for a fortnight. At the end of this time they were all going in quite naturally, so that it was a simple matter to close the opening. Catching them for their travelling crate was much more difficult, for guinea fowl have strong wings and can easily wriggle out of one's grasp. It is necessary to be quick and keep a tight hold with both hands. Adult cocks can, and sometimes do, peck, and it is painful. Some people pinion them at a week old to stop them flying. This surely is a pity, for they look very attractive in flight.

Before the war guinea fowl were in demand during February, March and April, when game was out of season. They have dark, gamey flesh and are very plump and tasty. They should be killed by wringing their necks, not bled, and hung by the legs for a week at least.

There is an old country saying, "A farm that has guinea fowl has no rats," meaning, I suppose, that guinea fowl are such good scavengers, that they leave nothing eatable for rats. Or could it mean their cries? Anyway, it is not so, I only wish it were !

FARMING AFFAIRS

A New Farming Year The farming year ended September 30 is a pointed reminder of the uncertainty of the farming business. Seldom or never were the prospects of an abundant harvest brighter and rarely has the ingathering been more difficult and disappointing.

The worldly hope men set their hearts upon
Turns ashes—or it prospers; and anon,
Like snow upon the desert's dusty face,
Lighting a little hour or two—is gone.

Nevertheless, hope sustains the husbandman and he will enter the new year expectant of better luck next time. How should he start? Clearly by sitting down to the prosaic task of making an inventory and valuation. And he should make up his mind to maintain throughout the year a record of all cash paid out and all cash received. He must know what debts are owing to him and payable by him. For ordinary purposes the records need be no more elaborate than will enable the farmer to fill up Income Tax Account Form 79D, a copy of which he can obtain from the local Inspector of Taxes. The essential requirements are a diary, a cheque book, and an account book with columns sufficient to cover the relevant items mentioned in the Form referred to.

As regards actual farming, October is, of course, the chief month for the sowing of winter cereals and beans. In the south, where row crops and rotational cropping now figure less prominently than in the past, it will usually have been advisable to attempt some stubble cleaning. The surface, this year, is easily penetrable and conditions are favourable for the germination of weed seeds. A deep covering furrow to follow will put most weeds out of the way. Most farmers soon get to know which cereal varieties suit their conditions best. For land in good heart varieties with relatively short and stiff straw will usually be chosen, particularly for combine harvesting. But short straw is not very effective in suppressing weeds, nor is it necessarily productive. For soils of only moderate or low fertility, farmers should think twice before entirely abandoning the older, fairly strawy, but trustworthy varieties that will normally stand up. Another such growthy year is not likely to recur for some time. It would, therefore, be unwise to withhold the usual dressing of fertilizers. Some phosphate and potash with just a little nitrogen are particularly valuable for giving the plant a good start, and if growth is too "proud" in spring it can generally, in one way or another, be toned down and even turned to good account.

Beans having apparently taken a new lease of life, many farmers will be disposed to chance them again. The season favoured beans, possibly because growth was unchecked throughout. Beans like moisture and in a dry year this is where dung comes in. Since dry years are more common in the south than wet ones, a dressing of dung supplemented by phosphate is, as a rule, the surest means to a good crop.

Grass is so abundant everywhere that it should generally be possible to shut up a field or two for use in late winter or spring when other fields are bare. Once growth ceases, even the most luxuriant pasture stocked to anything approaching its summer grazing capacity will cease to nourish animals after about a month. It will then have to be supplemented by kale, silage, hay or other appropriate fodder, supplies of which, in general, are more than usually abundant. But this does not mean that anything which can be carried over for a possible lean year should not be rigidly economized.

Inevitably this year, owing to the wet and protracted harvest, there will be large quantities of spoilt grain unfit for human nutrition or the fermentation industries. The best of it should be reserved for dairy cows and the more inferior diverted to other cattle, poultry and the traditional scavengers of the farm—pigs. There is appreciable loss of nutritive value through sprouting, but the chief agents in the deterioration of the grain are moulds. At the higher temperatures reached by grain stored in damp condition, moulds and other organisms may produce, especially from the proteins, decomposition products dangerous to animals. The only way to ensure reasonable safety is by steaming and the rejection of any condensation that may drain off. Obviously the first essential is to get damaged grain dried as quickly as possible to a safely storable condition. In using it, the feeder must be guided by the reaction of his livestock when it is offered in small quantities.

Grain, moreover, is not the only damaged product in greater supply than usual. Blight has taken toll of potatoes and large quantities may be available for pigs. Unfortunately, in damaged grain, there is a definite fall in protein value which should, if possible, be made good when such grain is fed with potatoes to pigs.

J. G. Stewart

Farming Cameo : 1. Louth, Lindsey The Louth District is a truly rural one, consisting of about 130,000 acres, rather more than half of which is grass. It extends in a circle around the market town of Louth and is bounded on the east by the sea and on the west by the crest of the Wolds.

Various types of soil are met with, but the general picture is one of chalky wold land, merging, as we travel eastwards, into boulder clay, clays of marine origin and, to the north-east, an intensively farmed area of silt, possibly derived from the river Humber. Oddly enough, the wold land is pocketed here and there with boulder clay, giving a soil well adapted to potato growing, and sands and gravels, which can be very acid indeed. Most of the typical wold farms are large, with correspondingly large fields, well suited to the use of combines ; one holding of 440 acres consists of four fields only. The buildings are extensive and adapted to the practice of yard wintering cattle which are summered on the marshes. The thinner soils are cropped on the four-field system, with barley and mutton the chief saleable products—a system which is very susceptible to slumps, as members of the last generation know only too well. Wireworms and rabbits take a heavy toll of the crops on this land. Here and there better fields are being cropped with potatoes and grass seed crops. The isolation and exposed site lends itself well to seed production. Weird results have been obtained by deep-ploughing some of the chalky land and trying to grow potatoes before fertility has been built up by two or three years of generous fertilizing. With a rainfall of about 25 inches, leys are something of a gamble, but are obviously replacing some of the poor weedy fescue swards. Last year, a very dry one, a moderate 25-acre field sown down with a timothy-meadow fescue-white clover mixture summered 240 wethers, a good proportion of which went off fat.

As we drop down from the Wolds to the sea we find a belt of land well adapted to growing peas—the most suitable conditions in the Empire we are told, and this reflects itself in the current acreage, which is about 10,000. Growers are well catered for with vining and canning facilities in the town for a proportion of the crop, and it is fairly true to say that prosperity in this section is as dependent on the pea harvest as Wold farmers are on

sheep and barley prices. Water is still the problem in this zone, only now we have too much ; higher up we had too little. When it does rain higher up, the drains through the marshes have to carry a large volume of water to the sea in a short time, and this gives the Drainage Engineers many a headache.

Although this is generally regarded as an arable district, there are hundreds of acres of valuable grassland between Louth and the sea, and last spring prices up to £12 per acre were realized for many lots. In the eyes of the botanist these pastures may have no outstanding merits, yet they have a regular rest from November to April, and this, linked with a constant water supply, enables graziers to get fat bullocks off at the rate of one to the acre in many instances. Nearly all the cattle are Lincoln Reds—each Friday Louth Market is well filled with good Red cattle, and bullocks coming forward for grading now are weighing out at 14 cwt. or so. Other breeds have come at the whim of the theorist, but they do not seem to last ; no doubt, traditional farming has built up a strain of beast well adapted to local conditions.

One fact which the war brought home to many is the usefulness of the arable crops that can be grown when the marsh pastures have been ploughed up—if the drainage problems are first put right. The better the grass field the better the arable crops, but even moderate old meadow is found to exceed expectations when cropped. One of the A.E.C's. aims is to get as much old meadow as possible ploughed up, and intractable old arable, lacking in humus, laid down to a good seeds mixture.

A. Gane, *District Advisory Officer.*

Eradication of Bovine Tuberculosis

Answering a question in the House of Commons on June 29, 1950, Mr. George Brown, M.P., Parliamentary Secretary, Ministry of Agriculture and Fisheries, stated that agreement had been reached with representatives of the National Farmers' Union and the Milk Marketing Boards in Great Britain on the basis of a plan for eradicating bovine tuberculosis by areas and on the necessary revision of the Tuberculosis (Attested Herds) Scheme. The following statement giving details of the plan was circulated in the official report :

Our general objective is to stimulate progress in the voluntary eradication of tuberculosis from herds in all parts of the country, and to eliminate tuberculosis entirely from selected areas as they become ripe for such treatment. Since 1944 owners of attested herds have received only the T.T. quality premium of 4d. per gallon of milk sold (if they held a T.T. licence) and there has been no payment for beef or rearing herds.

Under the new arrangements, which are to operate from October 1 next, there will be

1. An attestation bonus as a contribution towards the cost of eradicating tuberculosis from the herd. This will be at the rate of 2d. per gallon of milk sold for four years, and 1d. per gallon for a further two years or, at the option of the farmer, at £2 per head of cattle for four years and £1 per head for two more years.

2. A continuing quality premium on T.T. milk in recognition of its superior hygienic quality at a minimum of 2d. per gallon from October 1 next until March 31, 1954. The minimum rates in each subsequent period of two years will be settled biennially from 1952 onwards, any adjustments upwards or downwards in the guaranteed minimum being made in the light of circumstances. The actual rates will be subject to negotiation at the annual February reviews for 1951.

In addition to the above payments the owner of an attested herd in which reactors occur after the end of the fourth year will, provided that he has complied with the rules of the Scheme, be paid compensation in respect of these reactors. A revised Attested Herds Scheme embodying the above bonus proposals will be made at an early date to come into operation on October 1 next (1950).

The general outline of the area eradication part of the plan, as agreed with producers' representatives, is fairly well known. Some details of the way in which it is to work, and of the areas first to be selected as free-testing and eradication areas are, however, still under

discussion, but I hope to make a further announcement in due course. This part of the plan will also come into operation in October. The estimated additional cost of the new proposals, as compared with the present arrangements, is about £½ million in 1950–51 and just over £1 million in 1951–52.

Rapid progress has been made during the past few years in the eradication of tuberculosis from dairy herds. I feel confident that these proposals will ensure the continuation of that progress and also provide a new stimulus for the owners of other herds, thereby laying the foundation for the final eradication of bovine tuberculosis from Great Britain within a measurable time.

New Tuberculosis (Attested Herds) Scheme In accordance with this statement, a revised Tuberculosis (Attested Herds) Scheme has been made and comes into operation on October 1, 1950. It provides for an attestation bonus on milk sales, or on head of cattle, at the rates and for the period specified in the statement. (From that date the quality premium on T.T. milk will be 2d. per gallon and will be guaranteed at that rate until March 31, 1954 ; and the separate premium of 1d. per gallon now paid in respect of milk from Attested Herds (other than T.T. herds) will be discontinued.)

The conditions of entry and the rules applicable to Attested Herds and Supervised Herds are much the same under the new Scheme as under the Scheme of 1938, which it replaces. Bonus payments will, however, date from the time when a herd is admitted to the Scheme as a Supervised Herd.

Special provision has been made to enable owners of herds which on the coming into operation of the Scheme are licensed to produce tuberculin tested milk but which are not Attested or Supervised, to continue to receive a total of 4d. per gallon more than the price of ordinary milk. The owner of every such herd should have received a form of application at the beginning of September, and if this was returned promptly the herd will have been declared a Supervised Herd with effect from October 1, 1950, notwithstanding that it had not passed two qualifying tests. The owner will, however, be required to observe the rules of the Scheme. Subject to that, he will receive, in addition to the quality premium of 2d. per gallon on T.T. milk, the attestation bonus of 2d. per gallon. The owners of such herds will be expected to proceed to full attestation within a reasonable period.

A copy of the Scheme, together with a form on which the herd owner was asked to state whether he wishes to receive bonus on milk sales or bonus on the number of cattle in the herd, has been sent to owners of all existing Attested Herds and Supervised Herds. The relevant Statutory Instrument 1950—No. 1126 may be obtained price 3d. (4d. by post) from H.M. Stationery Office or through a bookseller.

Forestry Research during 1948–49 The Forestry Commission's Report on its research work for the year ended March, 1949,* is divided into three sections. The first presents, under various headings, a comprehensive account of the work carried out by the Forestry Commission staff during the period under review, with an introduction by James Macdonald, the Director of Research and Education. Under Pathology reference is made to an, as yet, unidentified fungus which has made its appearance on sycamore in the north-east of London, a fungus which can cause the death of the tree. Predatory beetles have been imported to attack the harmful bark beetle *Ips sexdentatus* which had been causing damage to conifers in certain parts of Wales. The ecological work of the past year has been centred on beech, and a comprehensive investigation into the ecology of British beech woods is being carried out. Its natural

* H.M. Stationery Office or through any bookseller, price 1s. 9d. (1s. 11d. by post).

habitat appears to be the southern counties, but beech has, of course, been planted in every part of Britain, although many sites are scattered and small. Another interesting fact revealed by the report is the outstanding success of broom as a nurse crop for establishing species of conifer which have previously failed.

Part II is a summary report by Dr. E. M. Crowther on the experiments conducted in 1948 by the Research Officers of the Committee on Nutrition Problems in Forest Nurseries in co-operation with some of the staff of the Chemistry Department of Rothamsted Experimental Station. These investigations have been in progress since 1945. The final section of the volume is devoted to an account of the research undertaken for the Forestry Commission, with the help of grants from the Forestry Fund, by workers attached to Universities and other institutions, and is introduced by Mr. V. Laurie, Chief Research Officer. Seven brief progress reports cover experiments being conducted at the Imperial Forestry Institute, Oxford, the Macaulay Institute for Soil Research, Aberdeen, Bedford College, London, the Department of Botany, Cambridge, the Department of Forestry, Aberdeen, and the Edward Grey Institute for Field Ornithology, Oxford, the last-mentioned being an investigation into the nesting of tits in boxes to establish whether and to what extent the tit population can be increased by providing nesting-boxes and to determine the part played by tits in controlling insects pest in forests, particularly defoliating caterpillars.

BOOK REVIEWS

Country Magazine. Compiled and edited by FRANCIS DILLON. Odhams. 10s. 6d.

It is the essentially human quality of the B.B.C. programme "Country Magazine" that it has made it so outstandingly popular. Every alternate Sunday since May 3, 1942, a rural cavalcade has passed before the microphone for the delectation, rather than entertainment, of hundreds of thousands of listeners. Literally, out of the highways and byways of rural Britain country men and women have stepped for a few moments to speak of their daily work and their life interests, often with a note of pride in their own particular part of the country or in the consciousness of their ability to do a job well. Dale Robinson, for example, who comes from the Yorkshire Wolds said: "I am proud of the Wold. We produce some of the best corn and the best sheep, and, if I may say so, some of the best men and women you can find in the whole of England." But lack of water is a serious handicap: "The only water most of us Wolds farmers have is the rain water off our roofs. We store it in cisterns and we grow quite miserly about it. In the summer we're carting water for miles every day, and that means we can't raise many cattle."

"Fisherman" Dick is a handyman: "I reckon I can turn me hand to most anything on the land. I can plough and sow and reap and mow. I can dig a ditch, lay a hedge, do a bit of draining or thatching, and 'most any carpentering job. I built a shed once, and all the tools I had was a billhook, a saw, an iron chisel, a hammer, a few nails, a jar of cider and a bottle of water, for a spirit-level."

The parson and policeman, doctor and vet, squire and sexton, shopkeeper and village craftsman, all are represented in this book. Mr. Cossons, a bank manager in Suffolk, has something to say about the dangers of small-talk in a subject that has always been thought to be safe enough: "The weather's a subject that has to be handled very carefully in a country bank. You say: 'Nice day, Mr. Blank,' and he'll say: 'Too dry, I want some rain for my roots.' So when the next farmer comes in you say: 'Lovely day, but I suppose you want some rain.' 'Rain! I don't want no rain for another ten days till I get up my hay'."

Thanks very largely to its producers (notably Francis Dillon) the broadcasts well preserved the individuality of every speaker and the warmth of colloquial expression in an atmosphere of cordial informality. Cold print inevitably fails where the spoken work succeeded, yet this collection of some 300 excerpts will be read with a good deal of pleasure and, I venture to say, not a little instruction.

S.R.O'H.

Pioneers of Fertility. CRICHTON PORTEOUS. Fertiliser Journal. 10s.

Mr. Porteous has sketched very interestingly the lives and work of twenty-two men who, from the sixteenth century onwards, strove assiduously to increase the efficiency of British farming. He starts with a brief survey of man's first fumblings towards the secret of soil fertility, when the Celts dug chalk from 100 feet down to put on their fields, believing that the deeper its source the more effective it was, and cultivators in Saxon times used such strange manures as wine and beer dregs, sheep's trotters, hogs' hair and seal hair. Then he goes on to tell, one by one, of notable pioneers who deserve to be rescued from the dim mists of antiquarian lore and brought into the sunlight of the modern world to receive the praise that is their due.

So alongside the familiar figures of Coke of Norfolk—perhaps the most outstanding early patron of agriculture—Tull, Townshend, Arthur Young, the Dukes of Bedford and the rest, we find less famous figures. There is Walter Blith, a seventeenth century farmer-writer who had a clear vision of the fertility of which English land was capable ; John Houghton, a friend of Pepys, who circularized his excellent notions about ploughing and manuring ; right up to modern experts like Sir John Lawes, Sir Henry Gilbert, and Robert H. Elliot.

In each case, Mr. Porteous's enthusiasm for his subjects and his flair for picking out the salient features of their invaluable work make the book very readable. Mr. Michael Ayrton's imaginative illustrations complete a volume of real value.

D.G.

Vegetable Growers' Guide. C. H. OLDHAM. Crosby Lockwood. 25s.

Much useful information about our vegetable crops has been collected for this book, and it embodies a good deal of the author's personal observation and experience ; the book, indeed, might well be regarded as the garnering of a life-time. The student will no doubt find it particularly useful, for much space is given to botanical descriptions of the various vegetable plants, and information about their origins, including quotations from some of the older writers on the subject, is generously provided.

There are, however, a few points of criticism. On the botanical side, it is curious to find the author departing from accepted practice in botanical literature by consistently using the obsolete term "Orders" for generically related groups of plants (e.g., the *Cruciferae*) instead of "families". In stating that there are white and purple forms of sprouting broccoli, the author ignores the excellent green-sprouting form which is so popular in North American and in some Continental countries and is grown also in this country. It should have been mentioned in a book of this type. Botanists would be reluctant to agree with the statement that "the cultivated asparagus is a dioecious plant," because although some plants produce a high proportion of imperfect, i.e., staminate or pistillate flowers, some plants produce also perfect or hermaphrodite flowers. If anything, asparagus is polygamous in flowering habit.

But, these and sundry misprints can be put right in a future printing ; they do not really detract from the book's sound general value, and one cannot but have respect for the prodigious amount of painstaking labour the author has obviously bestowed upon its preparation.

A.H.H.

The Modern Dairy Goat. JOAN and HARRY SHIELDS. Pearson. 7s. 6d.

Food production makes a strong appeal to many county and urban dwellers who find in goat keeping not only an attractive, healthy occupation, but also a means of obtaining supplies of high quality milk from animals that are capable of consuming rough herbage as part of their diet, much of which would be refused by other farm stock.

Although goats do not form part of commercial stock production, the breeding of pedigree animals has been carried out in Great Britain for over sixty years, and remarkable results have been achieved.

Public prejudice, mostly founded on ignorance and hearsay, has, more often than not, inclined to condemn goat's milk as strong and unpleasant in smell and taste. This may, of course, be true of milk produced under bad conditions of husbandry but the modern well-bred dairy goat, properly managed, is capable of producing a high grade product free from smell and taint, which would compare favourably with the highest grade of T.T. cow's milk.

For a number of years there has been a shortage in the supply of cow's milk, and this fact has been instrumental in attracting many newcomers to the ranks of goat keepers who require practical guidance of an elementary character in the breeding, feeding and management of these useful little animals.

Goat keeping differs in almost every respect from milk production and livestock farming, but very little has been written on the subject in recent years. This book, however, with its seventeen short chapters and some 170 pages of clear print and pleasing illustrations, should prove a useful addition to the bookshelves of both experienced goat keepers and those who wish to take up this work.

G.W.S.

An Introduction to Agricultural Economics. EDGAR THOMAS. Nelson. 10s. 6d.

University lecturers and others concerned with the teaching of agricultural economics have long felt the need of a textbook which would give a concise and readable analysis of the economic structure of agriculture in this country. Professor Thomas has filled that need admirably. But this is not merely a book for the student and the teacher: it will be most useful for all those who seek to be well informed about the economic problems of British agriculture.

The book follows an established pattern for works of this kind. It begins with a discussion of the gross and net output of the industry and follows with four chapters of simple and lucid economics dealing with the three main factors of production, land, labour, and capital. There is a useful chapter on farm size and a valuable discussion of current legislation under the heading of land tenure. Agriculture and the general price level; prices, demand and supply in agriculture; agricultural marketing, and imperfect competition in agriculture are the remaining chapters.

A book such as this, of nearly 300 pages, must necessarily be a synthesis of material, and as such it should be judged. It is a book for the farmer and the general student, and it fulfils their requirements. It would be easy to pick holes here and there, and to complain of inadequate treatment. For example, the last chapter on imperfect competition is an excellent and much needed study of agricultural policy. In particular, it outlines marketing developments and the schemes operative under the Agricultural Marketing Act and the subsequent war-time developments. But during the last two decades development of marketing services has been world-wide, and some mention of policies elsewhere could not fail to have been of value.

Professor Thomas has, however, provided an answer to criticism of this kind. Indeed to my mind the chief merit of the book is that it provides, chapter by chapter, representative references to the full literature and data in the field of agricultural economics.

V.M.W.

Britain's Green Mantle. A. G. TANSLEY. Allen and Unwin. 18s.

It is gratifying to note the increasing interest now being taken throughout the biological and agricultural world in the conservation of vegetation. In some countries it is being recognized that if one conserves the vegetation at an optimum level, the soil and the water which it contains or which falls upon it will also be conserved. In other countries, and these include Great Britain, the interest is more in the conservation of vegetation for its own sake, an attempt to retain on a permanent basis at least some of the "heritage of wild nature".

In the excellent work of stimulating a greater appreciation of the vegetation of Britain, Professor Tansley has played a leading, if not *the* leading part. His monumental work, *The British Islands and their Vegetation* (Cambridge University Press, 1939), has become the standard reference book for botanists, ecologists, agricultural and land improvers and naturalists generally. The work now under review, although containing much material from the larger version, has been brought down in size and technicality to meet the needs of the more general reader.

Professor Tansley has intentionally and quite naturally not attempted to deal with the ecology of farm crops, although these contribute greatly to the green protective cover of Britain, and "form a topic which would have to be treated quite differently". Readers of *Agriculture* concerned with economic return must turn primarily to the chapters dealing with forests and grasslands.

The forester will find much to interest him in the chapter on the plant covering and its changes (the Royal Forests, the origin of coppice-with-standards, the fashion of tree planting, and the trend towards grassland), and in the chapters, with their excellent illustrations, dealing respectively with the British oakwoods, the English beechwoods, chalk scrub and yew wood, ash, alder, pine and birch woods, and scrub vegetation in general.

The grasslands are dealt with in two chapters: the first covering meadow, pasture, and chalk down; and the second, hill grazings, grass heath and grass moor. The emphasis is on ecological relationships, reactions to environment, and botanical composition, rather than on economic value and utilization, but those concerned with these latter aspects will find much to interest and guide them in formulating recommendations for management and improvement. The remaining chapters deal with heath, moor and bog, mountain and freshwater vegetation, marsh and fen, and the maritime vegetation of salt marsh, foreshore and sand dunes, shingle beaches and similar habitats.

If Professor Tansley's book succeeds in creating a wide interest in the conservation of the few relics of natural vegetation and in the ideals of such bodies as the Nature Conservancy, it will have achieved its objective and will lead to a better understanding between the ecologist and the economic exploiter of land.

R.O.W.

BOOKS RECEIVED

Tractors on the Farm (4th Edition). H. J. HINE. Farmer and Stock-Breeder. 7s. 6d.

British Council. Report for the Year 1949-50.

Right Way to Pig Keeping and Breeding (3rd Edition). ALAN MORLEY. ANDREW GEORGE ELLIOT. 5s.

Solar Radiation at Kew Observatory. Geophysical Memoirs No. 86. J. M. STAGG. H.M.S.O. 3s. 6d.

Corn and Corn Growing (5th Edition). HENRY A. WALLACE and EARL N. BRESSMAN. Chapman and Hall. 27s.

Plant Pathology. SIR EDWIN J. BUTLER and S. G. JONES. Macmillan. £3 3s.

Dairy Bacteriology (3rd Edition). B. W. HAMMER. Chapman and Hall. 36s.

Marketing Poultry Products (4th Edition). E. W. BENJAMIN, H. C. PIERCE and W. D. TERMOHLEN. Chapman and Hall. 36s.

Farmers and the Law. "*Farmer and Stock-breeder*" Legal Advisers. Farmer and Stock-Breeder. 7s. 6d.

Citrus Products. J. B. S. BRAVERMAN. Interscience Publishers. 40s.

Soils—their Origin, Constitution and Classification (3rd Edition). GILBERT WOODING ROBINSON. Allen and Unwin. 32s.

Farmers and the Law. "*Farmer and Stock-Breeder*" Legal Advisers. Farmer and Stock-Breeder. 7s. 6d.

Fruit for Small Gardens. D. S. CROWTHER. Collingridge. 6s.

Students Handbook to Farming Implements and Machinery. G. H. PURVIS. Littlebury. 12s. 6d.

Silos and Silage. H. IAN MOORE. Farmer and Stock-Breeder. 10s. 6d.

A Physical Land Classification. North East Development Association. 30s.

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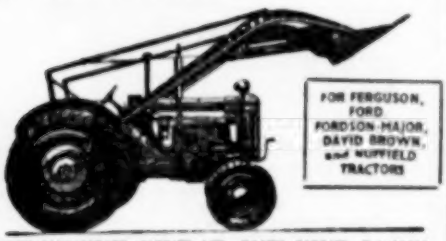

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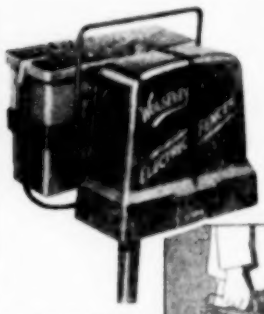

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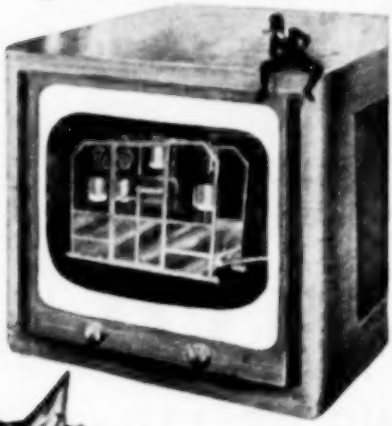

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